Michigan's 2019 Ambient Air Monitoring Network Review

Michigan Department of Environmental Quality
Air Quality Division
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INTRODUCTION

The purpose of this document is to examine Michigan's ambient air monitoring network, in operation during 2018, and recommend changes based on monitor history, population distribution, and modifications to federal monitoring requirements under the Clean Air Act (CAA), 40 Code of Federal Regulations (CFR) Part 58. Recommended changes to this network will be implemented during the 2019 calendar year contingent upon adequate levels of funding.

Federal Changes

There have been numerous changes at the federal level that have impacted design of the Michigan Department of Environmental Quality's (MDEQ) air monitoring network. These changes include revisions to the National Ambient Air Quality Standard (NAAQS) for ozone, particulate matter (PM), lead (Pb), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), carbon monoxide (CO), and secondary NAAQS for NO_2 and SO_2. In addition, there were changes in the ambient air monitoring rules.

On November 12, 2008, the United States Environmental Protection Agency (USEPA) modified the lead NAAQS by reducing the level of the standard from a maximum quarterly average of 1.5 micrograms per cubic meter ($\mu g/m^3$) to 0.15 $\mu g/m^3$ as a three-month rolling average.

On February 9, 2010, the USEPA changed the NO_2 NAAQS and required the deployment of a two-tiered NO_2 monitoring network consisting of near-roadway and community monitors. Design of the new NO_2 monitoring network is discussed in this network review. These NO_2 monitors had a deployment deadline of January 1, 2013.

On November 16, 2009, the USEPA proposed to modify the SO_2 NAAQS and proposed the creation of a two-tiered monitoring network based on SO_2 emissions, requiring a total of 12 SO_2 stations in Michigan. The SO_2 NAAQS became final on August 23, 2010. The network design was modified to a single tier requiring a total of five SO_2 monitors in Michigan. Changes to the SO_2 monitoring network are discussed in this network review. Changes to the SO_2 network were required to be implemented before January 1, 2013.

On August 13, 2011, the USEPA proposed to retain the CO NAAQS level while adding additional monitoring requirements. The USEPA proposed that CO monitors be added to the near-roadway sites. These CO monitors had a deployment deadline of January 1, 2014.

A secondary NAAQS for NO_2 and SO_2 was proposed on February 12, 2010, and the final rule was effective June 4, 2012. The USEPA chose to retain the standards while adding additional monitoring requirements.

On January 15, 2013, the PM NAAQS was revised and the USEPA lowered the $PM_{2.5}$ annual average to 12.0 $\mu g/m^3$.

On October 26, 2015, the ozone NAAQS was revised and the USEPA strengthened the ozone 8-hour standard to 0.070 ppm.

On April 27, 2016, the USEPA finalized revisions to CFR Part 48, which contains ambient air monitoring requirements for criteria pollutants.

On December 22, 2016, the USEPA finalized a rule to remove the requirement of tier 3 near-road NO_2 monitors.

Recommendations for Michigan's Air Monitoring Network in 2019

The following changes will be made to Michigan's ambient air monitoring network during 2019. If funding cuts occur, additional changes to the network may need to be implemented.

In August 2016, the MDEQ, Air Quality Division (AQD) established a monitoring site in the 48217 ZIP code in southwest Detroit (261630097) for a one-year study. The study was completed in September 2017. The MDEQ proposes to continue sampling at this station in 2019 for continuous $PM_{2.5}$, SO_2, and five metals including lead.

In May 2018 the Lansing (260650012) monitoring site had to be relocated in an unanticipated move to 815 Filley Street and is now designated as Lansing Filley (260650018).

The MDEQ anticipated receiving funds in 2018 to establish new air monitoring sites in the vicinity of the new Gordie Howe International Bridge. Details were not known at the time of the 2018 Network Plan. Three new sites are identified as Trinity (261630098), DP4TH (261630099) and Clemente (261630100). The monitoring sites will measure air pollution before, during, and after construction of the international bridge crossing. In addition, the Fort St. (SWHS) (261630015) site will increase monitoring to include NO_x, continuous $PM_{2.5}$, and black carbon. The three new monitors will include the following measurements:

- **Trinity (261630098)**: meteorological parameters, NO_x, SO_2, CO, continuous $PM_{2.5}$, black carbon, and five trace metals including lead.
- **DP4TH (261630099)**: NOx, SO_2, CO, continuous $PM_{2.5}$, black carbon, and five trace metals including lead.
- **TBD (261630100)**: NOx, SO_2, continuous $PM_{2.5}$, black carbon, and five trace metals including lead.

The revised monitoring rule (80 FR 65292; October 26, 2015) requires Photochemical Air Monitoring Station (PAMS) measurements June 1 through August 31 at NCore sites that are located in Core-based Statistical Areas (CBSAs) with populations of 1,000,000 or more. As long as federal funding is made available for Michigan to fully fund two PAMS sites, the MDEQ will implement the following changes to its network starting June 2019. The NCore sites are located in Grand Rapids (260810020) and Allen Park (261630001). The parameters for PAMS include volatile organic compound (VOC) measurement by automated gas chromatography (Auto-GC), direct NO_2 measurements, carbonyl sampling, and mixing height measurement using ceilometers.

By January 1, 2019, the MDEQ is proposing to add a year-round NO_x monitor to the Jenison (261390005) site in lieu of a direct NO_2 monitor at Grand Rapids-Monroe (260810020). This is due to delay in PAMS funding from the USEPA. This will fulfill the NO_2 area wide requirement.

During 2018, the MDEQ will begin to make a method change for sampling of $PM_{2.5}$ in its network. A slow transition from the filter-based $PM_{2.5}$ Federal Reference Method (FRM) network to a continuous beta attenuation air monitor (BAM) network will be made. The following sites will result in a method change from the FRM filter-based instruments to the continuous Federal Equivalent Monitors (FEMs):

- Flint (260490021) will be a co-located site with a primary BAM (MetOne) and a secondary $PM_{2.5}$ filter FRM
- SWHS (261630015) will be a co-located site with a primary $PM_{2.5}$ filter FRM and a secondary BAM (MetOne)

- Seney (261530001)
- Houghton Lake (261130001)
- Tecumseh (260910007)

By January 1, 2019, the MDEQ is proposing to eliminate the following monitors:

- $PM_{2.5}$ filter-based FRMs at
  - Livonia (261630025)
  - Linwood (261630016)
  - Wyandotte (261630036)
- FEM BAM replace TEOMs at
  - Seney (261530001)
  - Houghton Lake (261130001)
  - Tecumseh (260910007)
- Dearborn (261630033) EC/OC
- Tecumseh (260910007) EC/OC
- Tecumseh (260910007) Speciation
- Eliza-Downwind (261630094)
  - NOx
  - CO
  - Meteorological Parameters
- FIA (261630039) – due to loss of site access
  - $PM_{2.5}$ FRM
  - $PM_{2.5}$ TEOM
  - Meteorological Parameters

Note: The Reed Street (260670002) TSP lead monitor has seen some recent elevated levels in 2018. Depending on how the concentrations look for the duration of 2018, we may elect to shut down or opt to keep it another year.

Network Review Goals

The Michigan Ambient Air Monitoring Network Review will describe the ambient air monitoring network, show how the network meets the USEPA's monitoring regulations, discuss the public comment procedure, summarize recent changes to the network, and address potential impacts of other actions in greater detail. All discussions of air monitors reference a unique 9-digit site identification code to remove all ambiguity regarding the monitor location.

Public Comment Process

The USEPA requires that the MDEQ document the process for obtaining public comments and include any comments received through the public notification process. On May 22, 2018, it was announced, through the AQD listserve, that this network review document was placed on the AQD section of the MDEQ Internet home page to solicit comments from the public and stakeholders. In addition, the public comment period will be announced in a press release. Reviewers are given 30 calendar days from the date the draft network review report is posted to provide written comments. Written comments are accepted until June 22, 2018 by e-mail and by parcel post (verbal comments are not accepted) and should be sent to:

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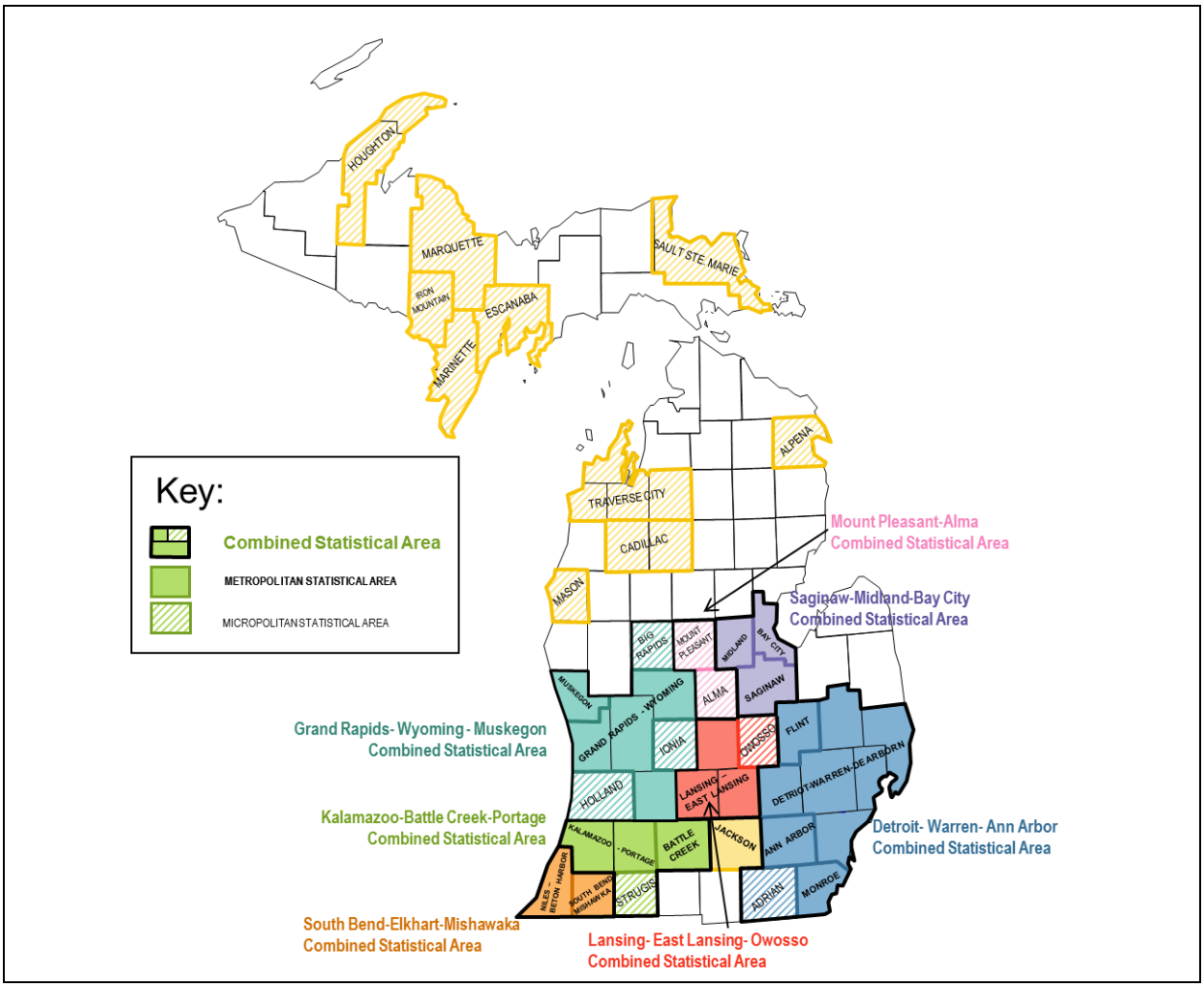
All written comments that are received will be organized by topic, summarized, and addressed in the final version of the Michigan Ambient Air Monitoring Network Review. The final document will be placed on the AQD section of the MDEQ Internet home page and sent to the USEPA's Region 5 office for approval. Hard copies of the final version will be available for inspection free of charge at the AQD offices located in Lansing (525 West Allegan Street) or Detroit (3058 West Grand Boulevard, Suite 2-300). Requests for hard copies of the plan may incur a nominal fee to cover copying and/or mailing costs. These requests should be directed to Navnit K. Ghuman, AQD, 313-456-4695, ghumann@michigan.gov.

AMBIENT AIR MONITORING NETWORK REQUIREMENTS

The minimum network design criteria for ozone, $PM_{2.5}$ (particulate matter with an aerodynamic diameter less than or equal to [≤] 2.5 micrometers) and PM_{10} (≤10 micrometers) are based on the 2017 Metropolitan Statistical Area (MSA) geographical borders, population totals, and historical concentrations. The MSA outlines for Michigan are shown in **Figure 1**.

Figure 1: MSAs in Michigan's Lower Peninsula



To be classified as an MSA, an area must have an urban core population totaling at least 50,000 people in the most recent decennial census. Micropolitan statistical areas contain an urban core of at least 10,000 (but less than 50,000). MSAs that consist of one or more counties have a sizeable urban cluster or a high level of commuting to or from an urban cluster. MSAs and/or micropolitan areas are grouped to form consolidated statistical areas (CSAs), also shown in **Figure 1**. A CBSA is defined as an entity consisting of the county or counties associated with at least one urbanized area/urban cluster of at least 10,000 in population, plus adjacent counties having a high degree of social and economic integration. Changes to the metropolitan and micropolitan areas as a result of the 2010 US Census were released in 2013. The areas affected include Midland, Hillsdale, Three Rivers, Ludington, and Whitehall. However, the remainder of MSAs in the state were unaffected by the 2010 census.

The specific counties that make up each MSA or micropolitan area in Michigan are listed in **Table 1**.[1] These geographical areas, coupled with their population totals and historical ambient monitoring data, were used to develop the minimum monitoring network design for ozone, $PM_{2.5}$, and PM_{10}. **Table 1** shows the adjusted 2017 population totals.

Table 1: Composition of Core-based Statistical Areas in Michigan

Combined Statistical Areas	2017 Projected Census Numbers	Core-based Statistical Areas	2017 Census data	County
Detroit-Warren-Ann Arbor CSA	5,336,286	Detroit-Warren-Dearborn MSA	4,313,002	Wayne
				Oakland
				Macomb
				Livingston
				St. Clair
				Lapeer
		Flint MSA	407,385	Genessee
		Ann Arbor MSA	367,627	Washtenaw
		Monroe MSA	149,649	Monroe
		Adrian Micropolitan	98,623	Lenawee
Grand Rapids-Wyoming-Muskegon CSA	1,456,935	Grand Rapids-Wyoming MSA	1,059,113	Kent
				Ottawa
				Montcalm
				Barry
		Muskegon MSA	173,693	Muskegon
		Holland Micropolitan	116,447	Allegan
		Ionia Micropolitan	64,291	Ionia
		Big Rapids Micropolitan	43,391	Mecosta
Lansing-East Lansing-Owosso CSA	546,102	Lansing-East Lansing MSA	477,656	Ingham
				Eaton
				Clinton
		Owosso Micropolitan	68,446	Shiawassee
Kalamazoo-Battle Creek-Portage CSA	533,413	Kalamazoo-Portage MSA	338,338	Kalamazoo
				Van Buren
		Battle Creek MSA	134,128	Calhoun
		Sturgis Micropolitan	60,947	St. Joseph
Saginaw-Midland-Bay City CSA	379,584	Saginaw MSA	191,934	Saginaw
		Bay City MSA	104,239	Bay
		Midland MSA	83,411	Midland
South Bend-Elkhart-Mishawaka, IN-MI CSA	727,604	South Bend-Mishawaka, IN-MI MSA	321,815	St. Joseph, IN
				Cass
		Elkhart-Groshen, IN MSA	205,032	Elkhart, IN
		Niles-Benton Harbor MSA	154,259	Berrien
		Plymouth, IN Micropolitan	46,498	Marshall, IN
Mount Pleasant-Alma CSA	112,081	Mount Pleasant Micropolitan	71,063	Isabella
		Alama Micropolitan	41,018	Gratiot
none		Jackson MSA	158,640	Jackson

[1] Metropolitan and Micropolitan Statistical Areas: April 1, 2010 to July 1, 2017 (CBSA-EST2009-1) Source US Census Bureau, Population Release Date March 2018.

Some proposed monitoring requirements are based on micropolitan statistical areas with an *urban cluster* of at least 10,000 but less than 50,000 people. The total population in micropolitan areas in Michigan is shown in **Table 2**.

Table 2: Composition of Micropolitan Statistical Areas in Michigan

Micropolitan Area	Principle Cities	Counties	Population 2017 Census
Adrian Micropolitan Area	Adrian	Lenawee	98,623
Alma Micropolitan Area	Alma	Gratiot	41,018
Alpena Micropolitan Area	Alpena	Alpena	28,462
Big Rapids Micropolitan Area	Big Rapids	Mecosta	43,391
Cadillac Micropolitan Area	Cadillac	Missaukee, Wexford	48,274
Coldwater Micropolitan Area	Coldwater	Branch	43,410
Escanaba Micropolitan Area	Escanaba	Delta	35,965
Hillsdale Micropolitan Area	Hillsdale	Hillsdale	45,879
Holland Micropolitan Area	Holland (pt.)	Allegan	116,447
Houghton Micropolitan Area	Houghton	Houghton, Keweenaw	38,410
Ionia Micropolitan Area	Ionia	Ionia	64,291
Iron Mountain Micropolitan Area	Iron Mountain	Dickinson, MI; Florence, WI	29,786
Ludington Micropolitan Area	Ludington	Mason	29,073
Marinette Micropolitan Area	Marinette, WI	Menominee, MI; Marinette, WI	63,356
Marquette Micropolitan Area	Marquette	Marquette	66,502
Mount Pleasant Micropolitan Area	Mount Pleasant	Isabella	71,063
Owosso Micropolitan Area	Owosso	Shiawassee	68,446
Sault Ste. Marie Micropolitan Area	Sault Ste. Marie	Chippewa	37,711
Sturgis Micropolitan Area	Sturgis	St. Joseph	60,947
Traverse City Micropolitan Area	Traverse City	Benzie, Grand Traverse, Kalkaska, Leelanau	148,671

Other Monitoring Network Requirements

National Core (NCore) sites provide a full suite of measurements at one location. NCore stations collect the following measurements: ozone, SO_2 (trace), CO (trace), NO_Y (reactive oxides of nitrogen), $PM_{2.5}$ FRM, continuous $PM_{2.5}$, speciated $PM_{2.5}$, wind speed, wind direction, relative humidity, and ambient temperature. In addition, filter-based measurements are required for PM coarse ($PM_{10-2.5}$) on a once every three day sampling frequency. Previously, a minimum of 10 NCore sites nationwide measure lead; however, this requirement was removed in 2016. The NCore stations in Michigan, located at Grand Rapids–Monroe St. (260810020) and Allen Park (261630001), became operational January 1, 2010, one full year ahead of schedule.

The 2015 Ozone Standard added an additional requirement to the NCore sites, by requiring PAMS monitors to be located at certain NCore sites. The two NCore sites in Michigan were initially required to implement PAMS monitoring on June 1, 2019, but due to a delay in federal funding, some parameters may not start until 2020. Certain states will also be required to implement enhanced ozone monitoring; however, since all nonattainment areas in Michigan are proposed to be marginal, this will not be required.

State and Local Air Monitoring Stations (SLAMS) monitors will supplement the network and improve spatial coverage. Specific network design criteria are contained in the monitoring

regulations that describe the SLAMS monitoring networks for criteria pollutants. These requirements are discussed in detail in the remainder of this review.

Network Review Requirements

According to 40 CFR 58.10, an air monitoring network review should:

- Be conducted at least once a year;
- Determine if the system meets the monitoring objectives stated in Appendix D of 40 CFR, Part 58 "Network Design Criteria for Ambient Air Quality Monitoring"[2];
- Determine if the system meets the appropriate spatial scales and monitoring objectives, population-driven requirements, and the minimum number of stations that are required based on the likelihood of exceeding the NAAQS;
- Identify needed modifications to the network including termination and relocation of unnecessary stations;
- Identify any new stations that are necessary;
- Correct any inadequacies previously identified; and
- Be used as a starting point for five-year regional assessments.

Elements that must be included in the network review are:

- The USEPA's Air Quality System (AQS) site identification number;
- Site locations including coordinates and street address;
- Sampling and analysis methods, including parameter codes;
- Operating schedule;
- Monitoring objective and spatial scales;
- Identification of those sites that are suitable and not suitable for comparison to the NAAQS (for $PM_{2.5}$ only);
- The MSA, CBSA, or CSA represented by each monitor; and
- Evidence that the siting and operation of the monitor meets 40 CFR Part 58, Appendices A (quality assurance requirements), C (ambient air quality monitoring), D (network design criteria) and E (probe and monitoring path siting criteria).

For Michigan, the site-specific data is summarized in various tables throughout the review. The modifications to the network should address:

- New census data;
- Changes in air quality levels; and
- Changes in emission patterns.

The time frame for implementation of modifications is one year from the time of the previous network review. Changes will be made on a calendar year basis whenever possible.

Monitor Deployment By Location

Table 3 summarizes the distribution of ambient air monitors by pollutant in operation in Michigan during 2018-2019. The distinction is made between building and trailer to indicate differences in floor space and temperature control, information useful in planning deployment of new monitors.

[2] "Environmental Protection Agency Ambient Air Quality Surveillance Regulations." 40 CFR Part 58 Appendix D, April 27, 2016.

TABLE 3: Monitor Distribution Throughout the 2018-2019 Network in Michigan

Site Name	AQS ID	O_3	$PM_{2.5}$	$PM_{2.5}$ TEOM	$PM_{2.5}$ BAM	Speciation	PM_{10}	PM Coarse	CO	Trace CO	NO_2	NOy	SO_2	Trace SO_2	Metals (TSP)	VOCs	Carbonyls	PAHs	Meteorological	Building/Trailer
Holland	260050003	x	x																x	T
Bay City	260170014		x	x															x	T
Benzonia (Frankfort)	260190003	x																		T
Coloma	260210014	x	x																x	T
Cassopolis	260270003	x																	x	B
Sault Ste. Marie +	260330901	x	x		x														x	
Rose Lake 2	260370002	x																		B
Flint	260490021	x	x	x															x	T
Otisville	260492001	x																	x	T
Harbor Beach	260630007	x																	x	T
Belding - Merrick St.	260670003														Pb & 4					
Lansing	260650012	x	x	x							x		x						x	T
Kalamazoo	260770008	x	x	x															x	T
Gr.Rapids-Monroe St.	260810020	x	x	x		x	x	x		x		x		x	Pb & 4				x	T
Evans	260810022	x																	x	T
Tecumseh	260910007	x	x	x															x	T
New Haven	260990009	x	x																x	T
Sterling Hts/Freedom Hill	260990021																		x	
Warren	260991003	x																		T
Manistee +	261010922	x	x																x	B
Scottville	261050007	x																	x	T
Houghton Lake	261130001	x	x	x		x					x								x	T
Monroe Sterling SP	261150006		x			x							x						x	T
Muskegon-Green Crk. Rd.	261210039	x																	x	T
Oak Park	261250001	x	x																x	T
Pontiac	261250011																		x	
Rochester	261250012																		x	
Jenison	261390005	x																	x	T
West Olive	261390011												x						x	T
Port Huron	261470005	x	x	x		x							x						x	T
Port Huron-Rural St.	261470031														Pb & 4					
Seney	261530001	x		x															x	T
Ypsilanti	261610008	x	x	x															x	T
Allen Park	261630001	x	x	x		x	x	x		x		x		x	Pb & 4				x	T
River Rouge	261630005														Pb & 4		x		x	T
Fort St. (SWHS) - Detroit	261630015		x		x	x	x						x		Pb & 4	x	x		x	B
Linwood	261630016		x																	B
E. 7 Mile - Detroit	261630019	x	x								x								x	B
Livonia	261630025		x																x	T
Joy Rd. - Detroit	261630026																		x	
S Delray / Jefferson	261630027														Pb & 4					T
Dearborn	261630033		x	x		x	x								x	x	x	x	x	B
Wyandotte	261630036		x																	
FIA / Ambassador Bridge	261630039		x	x															x	T
Eliza Howell	261630093								x		x								x	T
Livonia Near-road	261630095		x						x		x								x	T
NMH 48217	261630097			x									x		Pb & 4					T
DP4th	261630098				x				x		x		x		Pb & 4					T
Trinity	261630099				x				x		x		x		Pb & 4				x	T
TBD	261630100				x				x		x		x		Pb & 4					T
Total		27	25	14		7	4	2	5	2	8	2	9	2	12	3	3	2	39	

\+ = Tribal monitor

4 = Metals suite: Mn, As, Cd, Ni,

Quality Assurance

The MDEQ has an approved Quality Management Plan (QMP). The Air Monitoring Unit (AMU) has a Quality Assurance Project Plan (QAPP), which covers the operation of the ambient air network. The QAPP addresses criteria pollutants, air toxics, metals, and particulates including the USEPA $PM_{2.5}$ Speciation Trends Network (STN). Separate QAPPs exist for the National Air Toxics Trend Site (NATTS) and NCore. Special purpose monitoring projects also have dedicated QAPPs. The AMU has approved standard operating procedures, standardized forms and documentation policies, and a robust audit and assessment program to ensure high data quality.

As part of the network review process, it is important to ensure that each monitor meets the specific requirements set forth in 40 CFR Part 58, Appendix A that govern proper calibration and operation, proper probe height, and monitor path length. In addition, the site itself must meet specific criteria governing distance from large trees and buildings, exhaust vents, highways, etc. To address the adequacy of required operational parameters, various types of audits are performed.

The USEPA finalized revisions to the ambient air monitoring requirements for criteria pollutants, which were published in the *Federal Register* on March 27, 2016, and became effective on April 27, 2016. The MDEQ has finished implementing these changes.

Audits are conducted by the AMU's Quality Assurance (QA) Team, which has a separate reporting line of supervision. The audits are conducted on the particulate-based monitors every six months ($PM_{2.5}$ FRM, continuous $PM_{2.5}$ TEOM, BAM, $PM_{2.5}$ Speciation, High Volume TSP [total suspended particulate], and PM_{10}) and the gaseous monitors (CO, SO_2, O_3, NO_y, and NO_2) at least once each year. All audit results are reported to AQS quarterly. The toxics monitors (VOCs, carbonyl compounds, and poly-aromatic hydrocarbons [PAH]) are also audited once each year, and the aethalometers are audited every six months by the QA Team. These audits are conducted with independent equipment and gases, which are only used for quality assurance. The AMU's QA Coordinator reviews the results from all audits.

External audits are conducted annually by the USEPA. The USEPA conducts Performance Evaluation Program (PEP) audits for $PM_{2.5}$ samplers (eight sites per year) and National Performance Audit Program (NPAP) for the gaseous monitors (20% of the sites per year) using a Thru-the-Probe audit system. The USEPA also conducts program-wide Technical Systems Audits every three years to evaluate overall program operations and assess adequacy of documentation and records retention. External audits are also conducted on the laboratory operations for air toxics (VOCs and carbonyls) and metals through the use of performance evaluation samples. The concentrations of audit samples are unknown to both the AQD staff and the MDEQ Environmental Laboratory staff.

LEAD MONITORING NETWORK

Background

On December 14, 2010, the USEPA revised the ambient monitoring requirements to better address possible exposures to lead[3]. On January 5, 2015, the USEPA proposed to retain the current standard. Monitoring is required for point sources that emit 0.5 tons of lead per year or more, if modeling indicates that the maximum concentration is more than half of the level of the air quality standard. If modeling indicates that there is little likelihood of violating the NAAQS, a waiver from monitoring may be obtained from the USEPA Regional Administrator.

The final component of the 2010 revisions to the monitoring regulations includes the addition of population-oriented lead monitors at NCore stations that are located in CBSAs with populations greater than 500,000. In the final monitoring regulations of 2016, the USEPA has removed lead monitoring requirement at NCore sites, provided the sites are attaining the standard. At this time, the MDEQ has determined that, to best meet the needs of our citizens, we will continue to monitor for lead at our NCore sites.

To place these new monitoring requirements into context, the 2008 lead NAAQS is reviewed below, as are changes already implemented in the lead network.

The 2008 Lead NAAQS

The 2008 lead NAAQS reduced the level of the standard from a maximum quarterly average of 1.5 µg/m^3 to 0.15 µg/m^3 as a rolling three-month average. To determine if the primary NAAQS is met, the maximum three-month average within a three-year period is compared to the level of 0.15 µg/m^3.

In addition to changing the level and form of the standard, the 2008 NAAQS changed monitoring requirements. The USEPA required that ambient monitoring be performed downwind of point sources emitting one ton or more per year of lead, unless modeling proved that the sources didn't pose a health risk. In 2010, the new per-ton threshold was reduced to 0.5 ton/year.

The NAAQS retained the TSP size fraction of lead, but acknowledged that agencies may, under certain conditions, measure lead as PM_{10} if low volume sampling devices are used. The MDEQ is currently using high volume TSP samplers to measure lead and will continue to do so for compliance with the NAAQS and consistency with historical data. The NAAQS requires that lead sampling be conducted on a once every six day schedule. The MDEQ follows the USEPA sampling schedule published yearly on the USEPA web site. These filters are analyzed by the MDEQ laboratory using ICP/MS.

[3] "Environmental Protection Agency National Ambient Air Quality Standards for Lead; Final Rule." 40 CFR, parts 50, 51, 53 and 58, November 12, 2008.

Point Source-oriented Monitoring

For 2019, there are no new facilities that need to be investigated with regard to the lead NAAQS requirements. In July 2017, the USEPA redesignated the Belding, Michigan area as being in attainment with the lead standard. The MDEQ will continue monitoring for lead at the Merrick St. site (260670003). The MDEQ is proposing to shut down lead monitor at the Reed St. site (260670002) at the end of 2018 due to continued values below the standard. The Merrick St. monitor will remain operational to detect fugitive lead emissions from the facility.

Non-source-oriented/NCore Monitoring Network Design

According to the November 12, 2008, lead NAAQS, each Core-based Statistical Area (CBSA) with a population equaling or exceeding 500,000 people shall have a lead monitoring station to measure neighborhood scale lead in the urban area. The USEPA has now reversed this with the 2016 monitoring regulation changes. The MDEQ has decided that retaining the lead monitoring at the MDEQ's two NCore sites is in the best interest of Michigan's citizens. In addition to the lead sites that were added on January 1, 2018, the MDEQ is adding three new lead monitoring sites near the Gordie Howe International Bridge. Additional site details are in the Special Purpose Monitoring section.

Lead Co-location Requirements

If a primary quality assurance organization (PQAO) has a mixture of source and non-source-oriented lead sites, the number of co-located lead sites is equal to 15% of the total number of these lead sites**. Table 4** describes the deployment schedule for various components of the lead network and shows the calculations for determining the number of co-located lead sites that are required.

As shown in **Table 4**, two co-located monitoring stations are now required for Michigan's lead network. Due adding lead to all metals site and the addition of the monitoring site for the Gordie Howe International Bridge project. Currently, the co-located site is at Dearborn. According to the *Federal Register,* the co-located site should be at the location with the highest lead concentrations, which would be at Port Huron–Rural Street (261470031).

The MDEQ prefers to retain one co-located lead site at the National Air Toxics Trend Site (NATTS) at Dearborn (261630033), which is located close to several industrial processes including a steel mill, automotive manufacturing plant, and a rail yard. The monitor is sited at Salina Elementary School. Typically, NATTS sites determine lead as PM_{10} using a high volume sampler and thus do not meet the monitoring requirements, which specify the use of a high volume TSP sampler or a low volume PM_{10} sampler under certain instances. However, the MDEQ opted to collect co-located lead measurements as both TSP and PM_{10} at the Dearborn site to continue generating trend data, promote comparability with other NATTS sites in the nation, and to determine precision for both size fractions. In addition, a MetOne SASS monitor supports the measurement of lead as $PM_{2.5}$, rounding out the suite of various particle sizes. In the past, the total number of lead sites in Michigan was less than 10, the co-located TSP samplers at Dearborn fulfilled the 15 percent co-location requirement for the lead network. In 2018, the MDEQ will add seven additional lead sites, resulting in a total of 13 sites. To fulfill the 15 percent co-location requirement, the most suitable co-location will be at Port Huron–Rural Street (261470031), where we are currently reporting the highest lead values in the network.

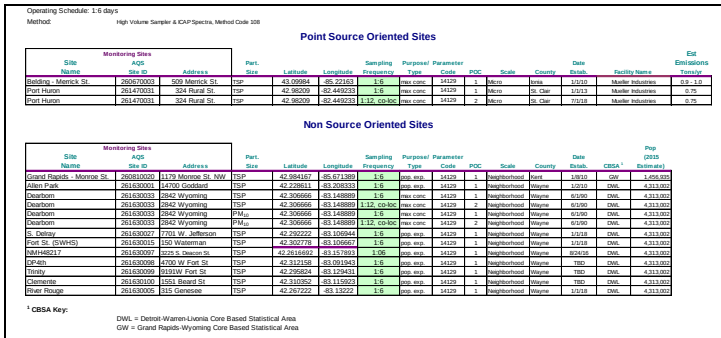
Table 5 summarizes the lead monitoring site information for the Michigan lead network. **Figure 2** shows monitoring site locations in the 2017 and 2018 network.

Table 4: Deployment Schedule for Lead Sites and Calculation of the Total Number of Co-located Lead Sites

Site Name & ID	Site Purpose	2015	2016	2017	2018	2019
Dearborn (261630033)	NATTS; co-located site	operational	operational	operational	operational	operational
Grand Rapids-Monroe St. (260810020)	NCore Non-source-oriented	operational	operational	operational	operational	operational
Allen Park (261630001)	NCore Non-source-oriented	operational	operational	operational	operational	operational
Belding (260670003)	Source-oriented	operational	operational	operational	operational	operational
Belding-Reed St (260670002)	Source-oriented	operational	operational	operational	operational	discontinued
S. Delray (261630027)	Non-source-oriented	----------	----------	----------	operational	operational
SWHS (261630015)	Non-source-oriented	----------	----------	----------	operational	operational
River Rouge (261630005)	Non-source-oriented	----------	----------	----------	operational	operational
Port Huron, Rural St. (261470031)	Source-oriented; New co-located site	operational	operational	operational	operational	operational
NMH48217 (261630097)	SLAMS Non-source-oriented	----------	----------	----------	operational	operational
Trinity (261630098)	Non-source-oriented	----------	----------	----------	Operational in July	operational
DP4TH (261630099)	Non-source-oriented	----------	----------	----------	Operational in July	operational
Roberto Clemente School (261630100)	Non-source-oriented	----------	----------	----------	Operational in July	operational
Total No. Sites		**6**	**6**	**6**	**13**	**12**
No. Co-located Sites Required		**1**	**1**	**1**	**2**	**2**

Table 5 summarizes the lead monitoring site information for the Michigan lead network. **Figure 2** shows monitoring site locations in the 2018 and 2019 network.

Table 5: Michigan's Lead Monitoring Network



Operating Schedule: 1:6 days

Method: High Volume Sampler & ICAP Spectra, Method Code 108

Point Source Oriented Sites

Monitoring Sites															
Site Name	AQS Site ID	Address	Part. Size	Latitude	Longitude	Sampling Frequency	Purpose/ Type	Parameter Code	POC	Scale	County	Date Estab.	Facility Name	Est Emissions Tons/yr
Belding - Merrick St.	260670003	509 Merrick St.	TSP	43.09984	-85.22163	1:6	max conc	14129	1	Micro	Ionia	1/1/10	Mueller Industries	0.9 - 1.0
Port Huron	261470031	324 Rural St.	TSP	42.98209	-82.449233	1:6	max conc	14129	1	Micro	St. Clair	1/1/13	Mueller Industries	0.75
Port Huron	261470031	324 Rural St.	TSP	42.98209	-82.449233	1:12, co-loc	max conc	14129	2	Micro	St. Clair	7/1/18	Mueller Industries	0.75

Non Source Oriented Sites

Monitoring Sites															
Site Name	AQS Site ID	Address	Part. Size	Latitude	Longitude	Sampling Frequency	Purpose/ Type	Parameter Code	POC	Scale	County	Date Estab.	CBSA [1]	Pop (2015 Estimate)
Grand Rapids - Monroe St.	260810020	1179 Monroe St. NW	TSP	42.984167	-85.671389	1:6	pop. exp.	14129	1	Neighborhood	Kent	1/8/10	GW	1,456,935
Allen Park	261630001	14700 Goddard	TSP	42.228611	-83.208333	1:6	pop. exp.	14129	1	Neighborhood	Wayne	1/2/10	DWL	4,313,002
Dearborn	261630033	2842 Wyoming	TSP	42.306666	-83.148889	1:6	max conc	14129	1	Neighborhood	Wayne	6/1/90	DWL	4,313,002
Dearborn	261630033	2842 Wyoming	TSP	42.306666	-83.148889	1:12, co-loc	max conc	14129	2	Neighborhood	Wayne	6/1/90	DWL	4,313,002
Dearborn	261630033	2842 Wyoming	PM_{10}	42.306666	-83.148889	1:6	max conc	14129	1	Neighborhood	Wayne	6/1/90	DWL	4,313,002
Dearborn	261630033	2842 Wyoming	PM_{10}	42.306666	-83.148889	1:12, co-loc	max conc	14129	2	Neighborhood	Wayne	6/1/90	DWL	4,313,002
S. Delray	261630027	7701 W. Jefferson	TSP	42.292222	-83.106944	1:6	pop. exp.	14129	1	Neighborhood	Wayne	1/1/18	DWL	4,313,002
Fort St. (SWHS)	261630015	150 Waterman	TSP	42.302778	-83.106667	1:6	pop. exp.	14129	1	Neighborhood	Wayne	1/1/18	DWL	4,313,002
NMH48217	261630097	3225 S. Deacon St.	TSP	42.2616692	-83.157893	1:06	pop. exp.	14129	1	Neighborhood	Wayne	8/24/16	DWL	4,313,002
DP4th	261630098	4700 W Fort St	TSP	42.312158	-83.091943	1:6	pop. exp.	14129	1	Neighborhood	Wayne	TBD	DWL	4,313,002
Trinity	261630099	9191W Fort St	TSP	42.295824	-83.129431	1:6	pop. exp.	14129	1	Neighborhood	Wayne	TBD	DWL	4,313,002
Clemente	261630100	1551 Beard St	TSP	42.310352	-83.115923	1:6	pop. exp.	14129	1	Neighborhood	Wayne	TBD	DWL	4,313,002
River Rouge	261630005	315 Genesee	TSP	42.267222	-83.13222	1:6	pop. exp.	14129	1	Neighborhood	Wayne	1/1/18	DWL	4,313,002

[1] CBSA Key:

DWL = Detroit-Warren-Livonia Core Based Statistical Area
GW = Grand Rapids-Wyoming Core Based Statistical Area

Operating Schedule: 1:6 days

Method: High Volume Sampler & ICAP Spectra, Method Code 108

Point Source Oriented Sites

Monitoring Sites															
Site Name	AQS Site ID	Address	Part. Size	Latitude	Longitude	Sampling Frequency	Purpose/ Type	Parameter Code	POC	Scale	County	Date Estab.	Facility Name	Est Emissions Tons/yr
Belding - Merrick St.	260670003	509 Merrick St.	TSP	43.09984	-85.22163	1:6	max conc	14129	1	Micro	Ionia	1/1/10	Mueller Industries	0.9 - 1.0
Port Huron	261470031	324 Rural St.	TSP	42.98209	-82.449233	1:6	max conc	14129	1	Micro	St. Clair	1/1/13	Mueller Industries	0.75
Port Huron	261470031	324 Rural St.	TSP	42.98209	-82.449233	1:12, co-loc	max conc	14129	2	Micro	St. Clair	7/1/18	Mueller Industries	0.75

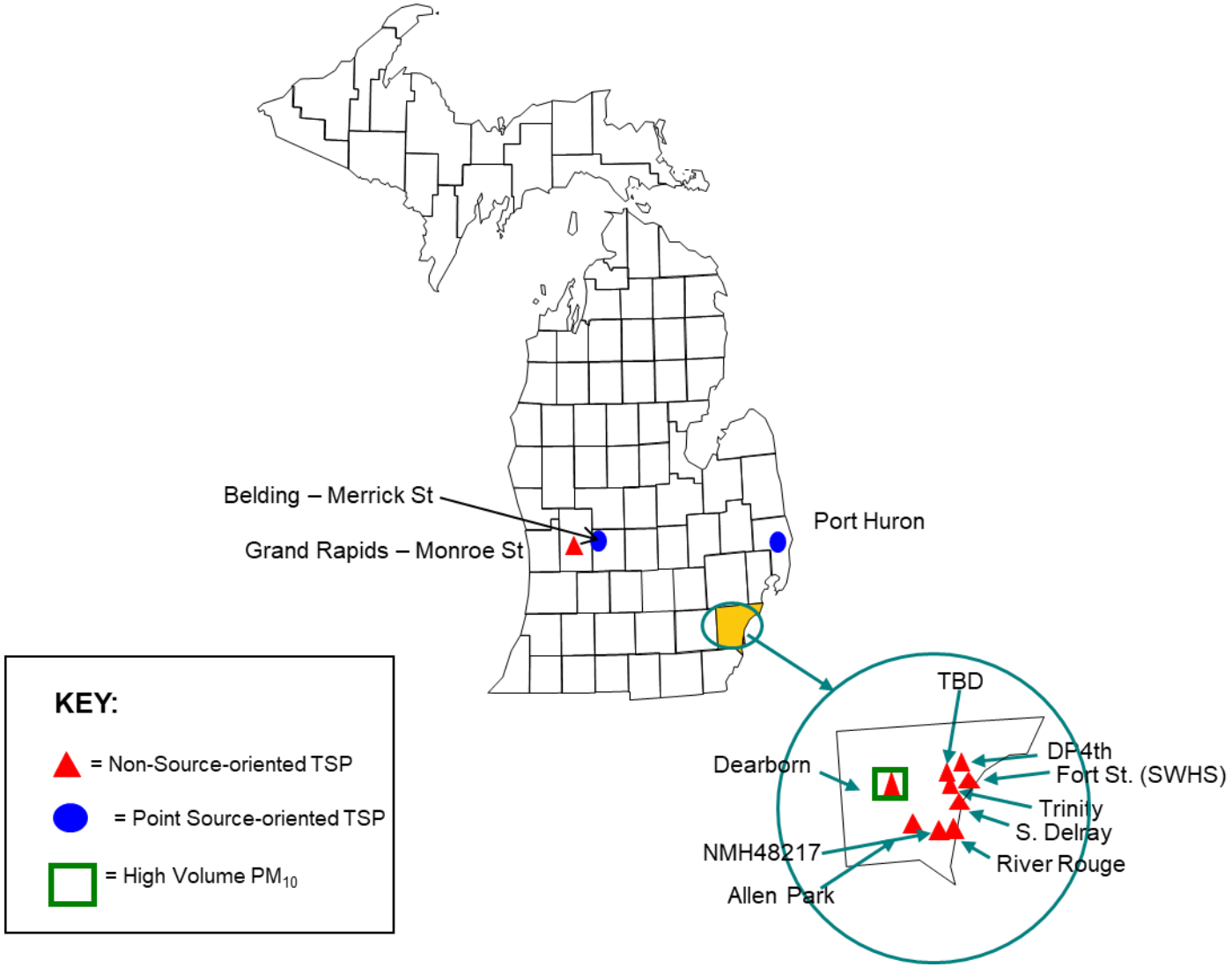
Non Source Oriented Sites

Monitoring Sites														
Site Name	AQS Site ID	Address	Part. Size	Latitude	Longitude	Sampling Frequency	Purpose/ Type	Parameter Code	POC	Scale	County	Date Estab.	CBSA [1]	Pop (2015 Estimate)
Grand Rapids - Monroe St.	260810020	1179 Monroe St. NW	TSP	42.984167	-85.671389	1:6	pop. exp.	14129	1	Neighborhood	Kent	1/8/10	GW	1,456,935
Allen Park	261630001	14700 Goddard	TSP	42.228611	-83.208333	1:6	pop. exp.	14129	1	Neighborhood	Wayne	1/2/10	DWL	4,313,002
Dearborn	261630033	2842 Wyoming	TSP	42.306666	-83.148889	1:6	max conc	14129	1	Neighborhood	Wayne	6/1/90	DWL	4,313,002
Dearborn	261630033	2842 Wyoming	TSP	42.306666	-83.148889	1:12, co-loc	max conc	14129	2	Neighborhood	Wayne	6/1/90	DWL	4,313,002
Dearborn	261630033	2842 Wyoming	PM_{10}	42.306666	-83.148889	1:6	max conc	14129	1	Neighborhood	Wayne	6/1/90	DWL	4,313,002
Dearborn	261630033	2842 Wyoming	PM_{10}	42.306666	-83.148889	1:12, co-loc	max conc	14129	2	Neighborhood	Wayne	6/1/90	DWL	4,313,002
S. Delray	261630027	7701 W. Jefferson	TSP	42.292222	-83.106944	1:6	pop. exp.	14129	1	Neighborhood	Wayne	1/1/18	DWL	4,313,002
Fort St. (SWHS)	261630015	150 Waterman	TSP	42.302778	-83.106667	1:6	pop. exp.	14129	1	Neighborhood	Wayne	1/1/18	DWL	4,313,002
NMH48217	261630097	3225 S. Deacon St.	TSP	42.2616692	-83.157893	1:06	pop. exp.	14129	1	Neighborhood	Wayne	8/24/16	DWL	4,313,002
DP4th	261630098	4700 W Fort St	TSP	42.312158	-83.091943	1:6	pop. exp.	14129	1	Neighborhood	Wayne	TBD	DWL	4,313,002
Trinity	261630099	9191W Fort St	TSP	42.295824	-83.129431	1:6	pop. exp.	14129	1	Neighborhood	Wayne	TBD	DWL	4,313,002
TBD	261630100		TSP			1:6	pop. exp.	14129	1	Neighborhood	Wayne	TBD	DWL	4,313,002
River Rouge	261630005	315 Genesee	TSP	42.267222	-83.13222	1:6	pop. exp.	14129	1	Neighborhood	Wayne	1/1/18	DWL	4,313,002

[1] **CBSA Key:**

DWL = Detroit-Warren-Livonia Core Based Statistical Area
GW = Grand Rapids-Wyoming Core Based Statistical Area

Figure 2: Michigan's Lead Monitoring Network



Waiver(s) From Lead Monitoring

In the Network Review that was due July 1, 2009, waivers from monitoring were sought for point sources where modeling indicated there was little likelihood to violate the NAAQS. These waivers were renewed again in July 2014. According to the waiver process, new waivers from monitoring for these sources need to be applied for five years after the first waiver was obtained. Therefore, the MDEQ will seek a waiver renewal in July 2019.

Lead Quality Assurance

The site operator conducts a precision flow check each month. The flow check values are sent to the QA Coordinator each quarter. An independent audit is conducted by a member of the AMU's QA Team every six months. The auditor is in a separate line of reporting authority from the site operator and uses independent, dedicated equipment to perform the flow rate audit. The auditor also assesses the condition of the monitor and siting criteria. The QA Coordinator reviews all audit results and hard copies are retained in the QA files. The audit results are uploaded to the USEPA's AQS database each quarter. External lead PEP audits are conducted annually by the USEPA. The USEPA uses a separate sampler at the monitoring station to collect a filter on the same day as an MDEQ sample. The USEPA's PEP filter is analyzed by an USEPA laboratory. Once the MDEQ enters the filter results in the AQS database, the USEPA enters the result from the co-located PEP filter for comparison.

The MDEQ Laboratory participates in an external performance testing program that is administered by the USEPA. The laboratory analyzes spiked filter strips each month which are reported to the USEPA AQS database. Once a quarter, the MDEQ sends a co-located lead filter to the USEPA Region 9 laboratory. The results from the primary filter, analyzed by the MDEQ Laboratory, are compared to the co-located filter that was analyzed by the USEPA Region 9 laboratory.

Plans for the 2019 Lead Monitoring Network

In 2019, the MDEQ is planning to continue to collect high volume TSP lead measurements at the NATTS site:

- Dearborn NATTS site (261630033); and
- Co-located Dearborn NATTS (261630033).

The MDEQ is also planning to continue the collection of co-located PM_{10} lead at the Dearborn (261630033) NATTS site during 2019.

In 2019, the MDEQ is planning to continue TSP lead measurements at:

- Port Huron (261470031);
- Co-located Port Huron (261470031);
- Belding–Merrick St. (260670003);
- S. Delray (261630027);
- Fort St. (SWHS) (261630015); and
- River Rouge (261630005).

In 2019, the MDEQ is planning to discontinue TSP lead source-oriented measurements at:

Belding-Reed St. (260670002). We have seen some recent elevated levels, depending on how the concentrations look for the duration of 2018, we may elect to shut down or opt to keep it another year.

In 2019, the MDEQ is planning to continue collecting lead measurements using high volume TSP samplers at the NCore sites in:

- Grand Rapids–Monroe St. (260810020); and
- Allen Park (261630001).

In 2019, the MDEQ is planning to add lead measurements using high volume TSP samplers at the following sites:

- DP4TH (261630098);
- Trinity (261630099); and
- TBD (261630100).

NCORE MONITORING NETWORK

The purpose of the NCore stations is to collect a variety of air quality measurements that can be used to provide an integrated approach to air quality management. Collection of a suite of measurements at a single site improves our understanding of how concentrations of various pollutants are inter-related and can evaluate the effectiveness of control programs. Data from NCore sites is also used for the determination of air quality trends, for model evaluation, and for attainment purposes. Reference or equivalent methods must be used.

Network Design

Neighborhood and urban scale measurements are to be made at one NCore site per state. Some states, including Michigan, have more than one major population center or multiple airsheds with unique characteristics, so two to three NCore stations are required to adequately characterize air quality. Sampling at NCore sites should use a spatial scale of neighborhood (up to 4 km) or urban (4 km to 50 km).

There are a limited number of rural NCore stations. These NCore sites are located away from the influences of major sources, are sited in areas of relatively homogeneous geography, and should sample on a regional scale or larger. There are no rural NCore sites in Michigan.

Whether urban or rural, the *Federal Register*[4] specifies the minimum parameters that each NCore site must measure:

- Continuous $PM_{2.5}$
- 24-hour $PM_{2.5}$
- Speciated $PM_{2.5}$
- $PM_{10-2.5}$
- Ozone
- Trace SO_2
- Trace CO
- NO/NO_Y
- Wind speed
- Wind direction
- Relative humidity
- Outdoor temperature
- Lead (2016 discontinued, not required)

Michigan NCore Sites

The MDEQ's NCore sites are located at Grand Rapids-Monroe St. (260810020) in the Grand Rapids-Wyoming CBSA and at Allen Park (261630001) in the Detroit-Warren-Livonia CBSA. Details were provided in the 2010 Network Review. The 2015 Ozone NAAQS has a requirement for PAMS monitoring at some NCore sites across the nation. These requirements for MDEQ are discussed in the PAMS chapter later in this review.

Tables 6 and **7** list the parameters measured at Grand Rapids-Monroe St. (260810020) and Allen Park (261630001), respectively. Start dates are also shown.

[4] "Environmental Protection Agency National Ambient Air Quality Standards for Lead; Final Rule." 40 CFR Parts 50, 51, 53 and 58, November 12, 2008.

Speciation samplers at the MDEQ NCore stations sample on a once every three day sampling schedule to meet the NCore monitoring requirements. The USEPA sampling schedule is followed.

Low volume PM_{10} was added to the Grand Rapids–Monroe St. (260810020) site on January 14, 2010 and was added to the Allen Park (261630001) site on January 8, 2010. Lead was added to both sites in January 2010. Humidity was added to the Grand Rapids–Monroe St. (260810020) NCore station on March 3, 2010.

Site specific data for Michigan's NCore network is summarized in **Table 8**. A map showing the locations of NCore sites is displayed in **Figure 3**.

NCore Quality Assurance

The MDEQ's NCore stations contain a variety of monitors that are required to meet the federal requirements for NCore stations. Quality assurance is discussed for each type of monitor in the appropriate section of the network review.

Plans for the 2019 NCore Monitoring Network

In 2019, the MDEQ is planning to continue to collect the measurements required for the NCore program at the following sites:

- Grand Rapids–Monroe St. (260810020); and
- Allen Park (261630001).

Lead monitoring will be continued at both sites, even though it is no longer required. PAMS monitoring equipment will be added to these sites as discussed in the PAMS chapter as federal funding becomes available.

Table 6: Measurements Collected at the Grand Rapids–Monroe St. (260810020) NCore Site

Parameter	Designation	Spatial Scale	Sampling Frequency	Instrument Type	Method	Existing Monitor Start-up Date	Comments
$PM_{2.5}$ continuous	NCore/AQI	Neighborhood	Continuous	R & P TEOM 1400 a	Tapered element oscillating microbalance	11/4/99	***DOES NOT meet FEM or ARM requirements***
$PM_{2.5}$ FRM mass	NCore	Neighborhood	1:3 days	R & P Partisol plus 2025	Manual collection, gravimetric analysis	10/23/98	---
$PM_{2.5}$ Speciation	NCore	Neighborhood	1:3 days	MetOne Super SASS + URG 3000N	Manual collection, laboratory analysis*	6/1/02 at 1:6 sampling frequency	Freq. changed to 1:3 on 1/1/2011
Trace CO	NCore/AQI	Neighborhood	Continuous	API 300 eu/ TECO 48 i	Non-dispersive infrared	4/25/07	probe height 5 m
Trace SO_2	NCore/AQI	Neighborhood	Continuous	API 100 eu/ TECO 43i	UV fluorescence	4/1/08	probe height 5 m
NO_y	NCore/AQI	Neighborhood	Continuous	TECO 42C	Chemiluminescence	4/1/08	external converter installed at 10 m
Ozone	NCore/AQI was NAMS	Neighborhood	Continuous	API 400 A1E	UV absorption	4/24/80	Year round
Lead	Non-source	Neighborhood	1:6 days	General Metal Works Hi Vol filter-based	Manual collection, ICP/MS analysis	1/8/10	Will continue, not required
$PM_{10\text{-}2.5}$ mass	NCore	Neighborhood	1:3 days	R & P Partisol plus 2025	Manual collection, gravimetric analysis	7/16/10	---
WS	NCore	---	Continuous	R. M. Young Prop. Anemom. & vane	Vector summation	1/1/88	At 10 m
WD	NCore	---	Continuous	R. M. Young Prop. Anemom. & vane	Vector summation	1/1/88	At 10 m
Relative Humidity	NCore	---	Continuous	R. M. Young	Resistance hygrometer	3/3/10	> 4 m
Outdoor Temperature	NCore	---	Continuous	R. M. Young	Thermometer	7/15/93	> 4 m
Sigma Theta	SLAMS	---	Continuous	R. M. Young Prop. Anemom. & vane	Calculation	1/16/01	Optional
Barometric Pressure	SLAMS	---	Continuous	R. M. Young	Electronic pressure sensor	7/15/93	Optional
PM_{10} Hi-vol	SLAMS	Neighborhood	1:6 days	Hi-vol	Manual collection, gravimetric analysis	1/1/85	---

* Laboratory analysis consists of ion chromatography, X-ray Fluorescence (XRF) and thermal optical analysis for ions, trace metals and forms of carbon, respectively.

Table 7: Measurements Collected at the Allen Park (261630001) NCore Site

Parameter	Designation	Spatial Scale	Sampling Frequency	Instrument Type	Method	Existing Monitor Start-up Date	Comments
$PM_{2.5}$ continuous	NCore/AQI	Neighborhood	Continuous	R & P TEOM 1400 a	Tapered element oscillating microbalance	2/1/01	***DOES NOT meet FEM or ARM requirements***
$PM_{2.5}$ FRM mass	NCore	Neighborhood	1:1 day	R & P Partisol plus 2025	Manual collection, gravimetric analysis	5/12/99	---
$PM_{2.5}$ Speciation	NCore	Neighborhood	1:3 day	MetOne Super SASS + URG 3000N + IMPROVE carbon channel	Manual collection, laboratory analysis*	12/1/00	---
Trace CO	NCore/AQI	Neighborhood	Continuous	API 300 eu/ TECO 48 i	Non-dispersive infrared	6/1/07	4 m probe ht
Trace SO_2	NCore/AQI	Neighborhood	Continuous	API 100 eu/ TECO 43 i as	UV fluorescence	4/1/08	4 m probe ht
NO_y	NCore/AQI	Neighborhood	Continuous	TECO 42C	Chemiluminescence	4/1/08	external converter installed at 10 m
Ozone	NCore/AQI was NAMS	Neighborhood	Continuous	API 400 E	UV absorption	1/1/80	Year round 4 m probe ht
Lead	Non-source	Neighborhood	1:6 days	General Metal Works Hi Vol filter-based	Manual collection, ICP/MS analysis	3/2/01 to 3/31/07; 1/2/10	Will continue, not required
$PM_{10\text{-}2.5}$ mass	NCore	Neighborhood	1:3 days	R & P Partisol plus 2025	Manual collection, gravimetric analysis	7/16/10	---
WS	NCore	---	Continuous	R. M. Young Prop. Anemom. & vane	Vector summation	10/18/81	At 10 m
WD	NCore	---	Continuous	R. M. Young Prop. Anemom. & vane	Vector summation	10/18/81	At 10 m
Relative Humidity	NCore	---	Continuous	R. M. Young	Resistance hygrometer	1/1/00	> 4 m
Outdoor Temperature	NCore	---	Continuous	R. M. Young	Thermometer	1/1/00	> 4 m
Sigma Theta	SLAMS	---	Continuous	R. M. Young Prop. Anemom. & vane	Calculation	9/1/01	Optional
Barometric Pressure	SLAMS	---	Continuous	R. M. Young	Electronic pressure sensor	1/5/71	Optional
Black Carbon	SLAMS	---	Continuous	Magee large spot AE21	Optical absorption	12/19/03	Not Req y NCore
PM_{10} Hi-vol	Was NAMS	Neighborhood	1:6 days	Hi-vol	Manual collection, gravimetric analysis	9/12/87	---

* Laboratory analysis consists of ion chromatography, X-ray Fluorescence (XRF) and thermal optical analysis for ions, trace metals and forms of carbon, respectively.

Table 8: Michigan's NCore Monitoring Network

Monitoring Sites										
Site Name	AQS Site ID	Address	Latitude	Longitude	Purpose/ Type	Scale	County	Date Estab.	CBSA[1]	Pop (2015 Estimate)
Grand Rapids - Monroe St.	260810020	1179 Monroe St., NW,	42.98417	-85.6714	Pop. Exp.	Neighborhood	Kent	1/1/10	GW	1,456,935
Allen Park	261630001	14700 Goddard	42.22861	-83.2083	Pop. Exp.	Neighborhood	Wayne	1/1/10	DWL	5,336,286

[1] CBSA Key:

DWL = Detroit-Warren-Livonia Core Based Statistical Area
GW = Grand Rapids-Wyoming Core Based Statistical Area

Figure 3: Michigan's NCore Monitoring Network

OZONE MONITORING NETWORK

On October 26, 2015, the USEPA revised the ozone NAAQS, lowering the standard to 0.070 ppm and extending the ozone season in many areas, including Michigan, from March 1 through October 31. The MDEQ began the expanded season in 2017.

As a result of the October 17, 2006 monitoring regulations, the minimum number of required ozone sites in an MSA were changed. In addition, due to the 2000 census, MSA boundaries were modified and population totals tied to measurements of ambient air quality were increased. A monitor with a design value (using the most recent three years of data) that is ≥ 85% of the ozone NAAQS has a higher probability of violating the standard. Therefore, the USEPA requires more monitors in these MSAs. In other instances, the number of monitors may be reduced if the design value is greater than 115% of the NAAQS.[5] Note: background and transport ozone monitors are still required but are not shown in **Table 9**.

Table 9: SLAMS Minimum Ozone Monitoring Requirements

MSA Population[1,2]	Most Recent 3-year Design Value Concentrations ≥ 85% of any Ozone NAAQS[3]	Most Recent 3-year Design Value Concentrations < 85% of any Ozone NAAQS[3,4]
> 10 million	4	2
4 - 10 million	3	1
350,000 - < 4 million	2	1
50,000 - < 350,000[5]	1	0

[1] Minimum monitoring requirements apply to the MSA.
[2] Population is based on the latest available census figures.
[3] The ozone NAAQS levels and forms are defined in 40 CFR Part 50.
[4] These minimum monitoring requirements apply in the absence of a design value.
[5] MSA must contain an urbanized area of 50,000 or more population.

Applying the requirements described in **Table 9** to Michigan's MSAs, population totals and the most recent 3-year design values results in a minimum ozone network design summarized in **Table 10**. All monitors in Michigan are above 85% of the ozone NAAQS of 0.059 ppm, except for Sault Ste. Marie, which is 0.057 ppm.

Figure 4 illustrates changes in the 3-year averages of the fourth highest ozone values, called design values, from 2013 to 2017. When contemplating changes to the ozone network, it is important to consider changes in design values in nonattainment areas. In 2015, the USEPA lowered the ozone NAAQS to 0.070 ppm. The design values for 2013-2015, 2014-2016, and 2015-2017 are compared to the new standard of 0.070 ppm.

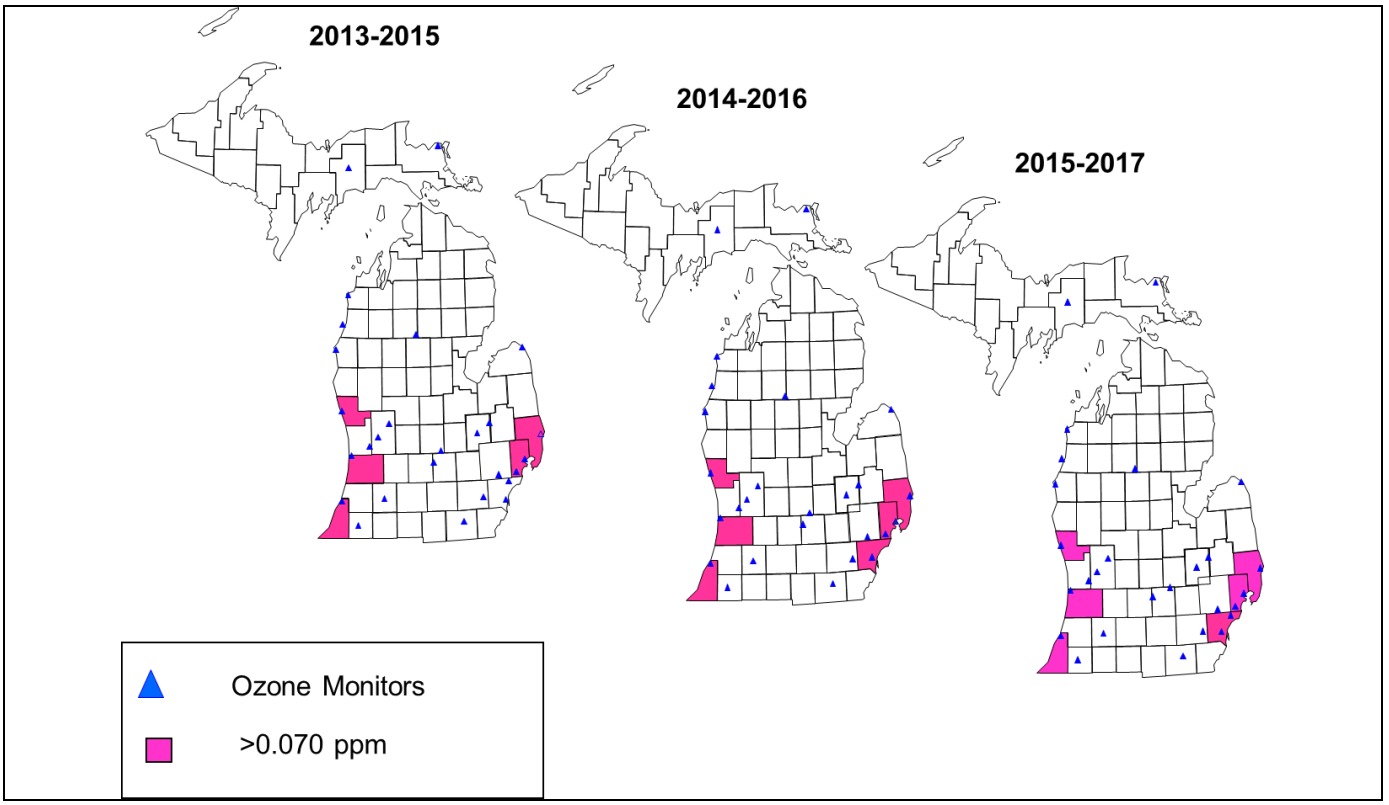
[5] Table D-2 of Appendix D to Part 58.

Table 10: Application of Minimum Ozone Requirements in the October 17, 2006 Final Revision to the Monitoring Regulation to Michigan's Ozone Network

NAAQS: 0.070 ppm
85% NAAQS: 0.059 ppm
Decimals to the right of the third decimal place are truncated.
The 3-year O3 average at the MSA Design Value site is shown in bold.
Values for sites ≥ 85% NAAQS are in red.

MSA	2015 Population	Counties	Existing Monitors	2015-2017 3-year O_3 design value	Min. No. Monitors Required
Detroit-Warren-Livonia MSA	4,313,002	Macomb	New Haven	0.071	**3**
			Warren	0.066	
		Oakland	Oak Park	0.070	
		Wayne	Allen Park	0.067	
			Detroit - E 7 Mile	**0.073**	
		Lapeer	---		
		St. Clair	Port Huron	0.072	
		Livingston	---		
Flint MSA	407,385	Genesee	Flint	0.067	2
			Otisville	**0.068**	
Monroe MSA	149,649	Monroe	---		
Ann Arbor MSA	367,627	Washtenaw	Ypsilanti	**0.067**	2
Grand Rapids-Wyoming MSA	1,059,113	Kent	Grand Rapids - Monroe St.	**0.069**	2
			Evans	0.068	
		Barry	---		
		Ottawa	Jenison	0.068	1
		Montcalm	---		
Muskegon-Norton Shores MSA	173,693	Muskegon	Muskegon - Green Creek Rd.	**0.075**	1
Lansing-East Lansing MSA	477,656	Clinton	Rose Lake	0.066	2
		Ingham	Lansing	**0.067**	
		Eaton	---		
Bay City MSA	104,239	Bay	---		
Saginaw MSA	191,934	Saginaw	---		
Kalamazoo-Portage MSA	338,338	Kalamazoo	Kalamazoo	**0.070**	1
		Van Buren	---		
Niles-Benton Harbor MSA	154,259	Berrien	Coloma	**0.073**	1
Jackson MSA	158,640	Jackson	---		
Battle Creek MSA	134,128	Calhoun	---		
South Bend Mishawaka MSA	321,815	Cass	Cassopolis	**0.072**	1
Other areas:	Comments				
	transport site	Lenawee	Tecumseh	0.067	
		Benzie	Frankfort	0.068	
		Huron	Harbor Beach	0.067	
		Allegan	Holland	0.073	
	background site	Missaukee	Houghton Lake	0.067	
		Mason	Scottville	0.068	
		Schoolcraft	Seney	0.067	
	tribal site	Manistee	Manistee	0.067	
		Chippewa	Sault Ste. Marie	0.057	

Figure 4: Comparison of 4th Highest 8-Hour Ozone Values Averaged Over Three Years 2013-2015, 2014-2016 and 2015-2017



In southeast Michigan, New Haven (260990009) has been the design value site for many years, measuring maximum ozone concentrations downwind from Detroit. However, in 2015, the Detroit E 7 Mile (261630019) monitoring site became the new design value site for the Detroit-Warren-Livonia MSA. The location of the maximum ozone concentration has fluctuated in recent years, possibly due to changes in the amount, type and location of ozone precursor emissions. Allen Park (261630001) is upwind of the central business district and is an NCore site for the Detroit-Warren-Livonia MSA. As such, the MDEQ is required to measure ozone over the entire year at the Allen Park (261630001) site, instead of only during the March through October ozone season in Michigan. The Oak Park (261250001) and Port Huron (261470005) monitors are the only ozone sites in Oakland and St. Clair Counties, respectively. All monitors in southeast Michigan, except for E 7 Mile (261630019), Port Huron (261470005) and New Haven (260990009) are meeting the current ozone standard of 0.070 ppm.

Two monitors are required in the Ann Arbor MSA. They consist of the Ypsilanti monitor (261610008) and the downwind monitor in Oak Park (261250001). The urban center city location coupled with a downwind maximum concentration site is a carry-over from the defunct NAMS network. There is not sufficient space in Washtenaw County to site a downwind monitor to measure maximum ozone concentrations, so Oakland County houses the downwind site although it is outside of the boundary of the Ann Arbor MSA. The upwind/downwind configuration will be retained wherever possible to preserve historical trend data.

Two monitors are required in the Flint MSA. They consist of the urban center city site in Flint (260490021) and the downwind site at Otisville (260492001).

Two ozone monitors are also required in the Grand Rapids–Wyoming MSA. They consist of the urban center city site in Grand Rapids on Monroe St. (260810020) and the downwind site at Evans (260810022).

Two monitors are required in the Lansing–East Lansing MSA consisting of the urban center city site in Lansing Filley (260650018) and the downwind Rose Lake 2 (260370002) location. The MDEQ lost site access to the old Lansing (260650012) site in April 2018.

A single ozone monitor is required in the MSAs of Holland-Grand Haven, Muskegon-Norton Shores, Kalamazoo–Portage, Niles-Benton Harbor, and South Bend-Mishawaka. The Jenison (261390005), Muskegon–Green Creek Rd. (261210039), Kalamazoo (260770008), Coloma (260210014) and Cassopolis (260270003) monitors fulfill these requirements, respectively. Coloma (260210014) and Muskegon–Green Creek Rd. (261210039) are violating the 0.070 ppm 8-hour ozone NAAQS.

The ozone monitor in Holland (260050003) is in Allegan County and is violating the 0.070 ppm 8-hour ozone NAAQS. This site has historically measured the highest ozone values in the state and historically has been the highest in the region; however, in 2017, Muskegon–Green Creek Rd. (261210039) had the highest ozone three-year average in the state.

The Lake Michigan Air Directors Consortium (LADCO) created the map shown in **Figure 5** comparing ozone concentrations across the region.

Tecumseh (260910007) measures ozone transport into southeast Michigan and is required by Michigan's maintenance plan. Harbor Beach (260630007) measures transport out of southeast Michigan under southwesterly winds. Scottville (261050007) and Benzonia (260190003) are sited to measure transport of ozone along Lake Michigan and have been in operation for 21 and 27 years, respectively. These two sites are also an important part of Michigan's maintenance plan. Houghton Lake (261130001) and Seney (261530001) measure background ozone levels in the Lower and Upper Peninsulas, respectively.

To the best of our knowledge, the tribal ozone sites in Manistee (261010922) and in Sault Ste. Marie (260330901) will continue to operate.

Figure 5: Ozone Design Values 2015 – 2017[6]

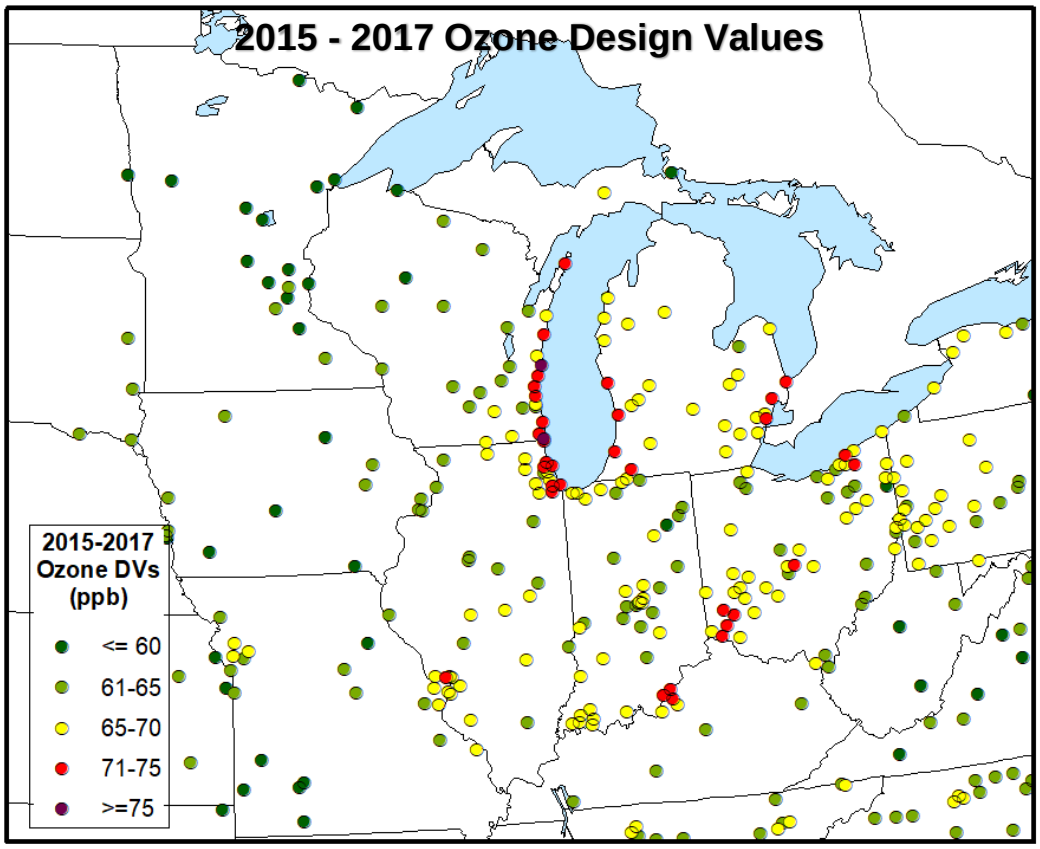


Table 11 summarizes the ozone monitoring site information for sites that were in existence in 2018 and are planned to be operational in 2019. **Figure 6** illustrates the geographical distribution of this network.

[6] Map provided by D. Kenski, Lake Michigan Air Directors Consortium

Table 11: Michigan's Ozone Monitoring Network

Operating Schedule Hourly, March 1 to Octover 31; *NCore operate hourly all year*
Houghton Lake and Lansing operate hourly all year

Former NAMS sites are shown in bold.

Method: Ultra Violet Absorption Continuous Monitor, Method Code 087

SLAMS Stations

NCore sites are shown in italics.

Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Purpose/ Type	Parameter Code	POC	Scale	County	Start Date	MSA[1]	Pop (2017 Estimate)
Rose Lake	**260370001**	**8562 E Stoll Rd**	42.7983	-84.39389	**max conc**	**44201**	**1**	**urban**	**Clinton**	**6/7/79**	**LEL**	**477,656**
Flint	**260490021**	**Whaley Park, 3610 Iowa**	43.0472	-83.67028	**pop exp**	**44201**	**1**	**nghbrhd**	**Genesee**	**6/16/92**	**F**	**407,385**
Otisville	**260492001**	**G11107 Washburn Rd**	43.1683	-83.46167	**max conc**	**44201**	**1**	**urban**	**Genesee**	**5/13/80**	**F**	**407,385**
Lansing Filley	**260650018**	**815 Filley Street**	42.7616	-84.5628	**pop exp**	**44201**	**2**	**nghbrhd**	**Ingham**	**5/17/18**	**LEL**	**477,656**
GR - Monroe St	***260810020***	***1179 Monroe NW***	*42.9842*	*-85.6714*	***pop exp***	***44201***	***1***	***nghbrhd***	***Kent***	***4/24/80***	***GW***	***1,059,113***
Warren	**260991003**	**29900 Hoover**	42.5133	-83.00611	**max conc**	**44201**	**1**	**urban**	**Macomb**	**1/1/77**	**DWL**	**4,313,002**
Holland	260050003	966 W 32nd St	42.7678	-86.14861	max conc	44201	1	urban	Allegan	8/25/92	A	116,447
Frankfort / Benzonia	260190003	West St., Benzonia Twp.	44.61694	-86.10944	max conc	44201	1	regional	Benzie	7/28/92	Not in MSA	N/A
Coloma	260210014	Paw Paw WWTP, 4689 Defield Rd.,Coloma	42.1978	-86.30972	max conc	44201	1	regional	Berrien	8/3/92	NBH	154,259
Cassopolis	260270003	Ross Beatty High School, 22721 Diamond	41.8956	-86.00167	pop exp	44201	2	urban	Cass	5/16/91	SBM	52,293
Harbor Beach	260630007	1172 S. M 25, Sand Beach Twp.	43.8364	-82.64306	backgrd	44201	1	regional	Huron	4/1/94	Not in MSA	N/A
Kalamazoo	260770008	Fairgrounds, 2500 Lake St	42.2781	-85.54194	pop exp	44201	1	nghbrhd	Kalamazoo	6/1/92	KP	338,338
Evans	260810022	10300 14 Mile Road, NE	43.1767	-85.41667	max conc	44201	1	urban	Kent	4/1/99	GW	1,059,113
Tecumseh	260910007	6792 Raisin Center Highway	41.9956	-83.94667	up w ind backgrd	44201	1	regional	Lenaw ee	7/6/93	AL	98,623
New Haven	260990009	57700 Gratiott	42.7314	-82.79361	max conc	44201	1	urban	Macomb	7/14/80	DWL	4,313,002
Houghton Lake	261130001	1769 S Jeffs Road	44.3106	-84.89194	background	44201	1	regional	Missaukee	4/1/98	Not in MSA	N/A
Scottville	261050007	525 W US 10	43.9533	-86.29444	max conc	44201	1	regional	Mason	4/1/98	Not in MSA	N/A
Muskegon - Green Ck	261210039	1340 Green Creek Road	43.2781	-86.31111	pop exp	44201	1	regional	Muskegon	5/1/91	MNS	173,693
Oak Park	261250001	13701 Oak Park Blvd.	42.4631	-83.18333	pop exp	44201	2	urban	Oakland	1/9/81	DWL	4,313,002
Jenison	261390005	6981 28Th Ave. Georgetown Twp.	42.8944	-85.85278	pop exp	44201	1	urban	Ottaw a	4/1/89	GW	1,059,113
Port Huron	261470005	2525 Dove Rd	42.9533	-82.45639	pop exp	44201	1	urban	Saint Clair	2/28/81	DWL	4,313,002
Seney	261530001	Seney Wildlife Refuge, HCR 2 Box 1	46.2889	-85.95027	bkgrd	44201	1	regional	Schoolcraft	1/15/02	Not in MSA	N/A
Ypsilanti	261610008	555 Towner Ave	42.2406	-83.59972	pop exp	44201	1	nghbrhd	Washtenaw	4/1/00	AA	367,627
Allen Park	*261630001*	*14700 Goddard*	*42.2286*	*-83.2083*	*pop exp*	44201	*2*	*nghbrhd*	*Wayne*	*1/1/80*	*DWL*	*4,313,002*
Detroit - E 7 Mile	261630019	11600 East Seven Mile Road	42.4308	-83.00028	max conc	44201	2	urban	Wayne	4/11/77	DWL	4,313,002

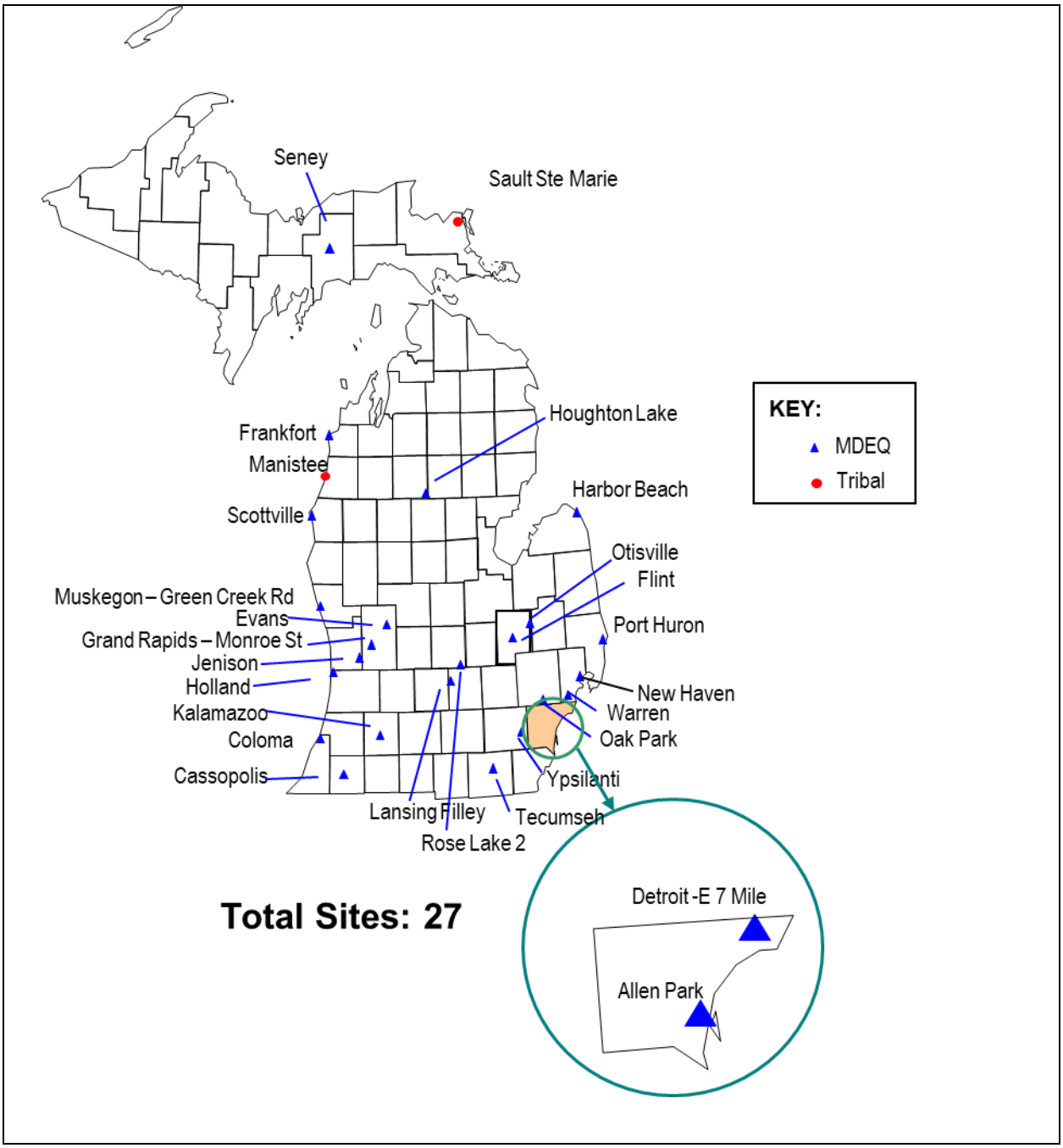
Tribal Stations

Site Name	Monitoring Sites AIRS Site ID	Address	Latitude	Longitude	Purpose	Purpose	Purpose	Scale	County	Start Date	MSA [1]	Pop (2017 Estimate)
Manistee	261010922	3031 Domres Rd	44.307	-86.24268	transport	44,201	1	regional	Manistee	4/1/06	Not in MSA	N/A
Sault Ste. Marie	260330901	650 W Easterday Ave	46.4936	-84.3641	transport	44,201	1	nghbrhd	Chippew a	1/1/12	Not in MSA	N/A

[1] MSA Key:

A = Allegan Micropolitan Area
AA = Ann Arbor MSA
AL = Adrian Micropolitan Area
DWL = Detroit-Warren-Livonia MSA
F = Flint MSA
GW = Grand Rapids-Wyoming MSA
HGH = Holland-Grand Haven MSA
KP = Kalamazoo-Portage MSA
LEL= Lansing-E. Lansing MSA
MNS = Muskegon-Norton Shores MSA
NBH = Niles-Benton Harbor MSA
SBM = South Bend-Mishawaka MSA (IN/MI)

Figure 6: Michigan's Ozone Network



Ozone Season and Modeling

The length of the ozone season was modified, with the enactment of the 0.070 ppm 8-hour primary NAAQS. The new ozone NAAQS final rule extends the ozone season in Michigan from March 1 through October 31. This new season started with the 2017 ozone season.

With the new 1-hour NO_2 NAAQS, modeling conducted as part of the permitting process for new source review (NSR) has indicated that many facilities in Michigan could violate the standard. More refined modeling is an option using the Ozone Limiting Method or Plume Volume Molar Ratio Method (PVMRM), but more site-specific 1-hour NO_2 background levels, as well as year-round ozone values, are necessary. Specifically, modeling staff need five years of ozone and NO_2 data collected in small cities, urban, and rural areas. While Allen Park (2616309001) and Grand Rapids–Monroe St. (260810020) generate ozone values in urban areas throughout the year, levels in smaller cities and rural areas were not available. Therefore, beginning October 1, 2010, the MDEQ began to monitor for ozone throughout the year at the Lansing (260650012) and Houghton Lake (261130001) stations. This will continue at the new Lansing Filley (260650018). The collection of additional NO_2 data to support NSR modeling is discussed in the NO_2 section.

Ozone Quality Assurance

Site operators conduct precision checks on the monitors every two weeks. The results of the precision checks are sent to the QA Coordinator for review each quarter. Each ozone monitor is also audited annually by the AMU's QA Team. The audit utilizes a dedicated ozone photometer to assess the accuracy of the station monitor. The auditor also assesses the monitoring system (inspecting the sample line, filters, and the inlet probe), siting, and documentation of precision checks. The results of the ozone audits and precision checks indicate whether the monitor is meeting measurement quality objectives. The AMU uploads the results of the precision checks and audits to the USEPA's AQS database each quarter. The QA Coordinator reviews all audits and hard copies are retained in the QA files.

The USEPA conducts thru-the-probe audits of 20% of the MDEQ's ozone monitors each year. The audit consists of delivering four levels of ozone to the station monitor through the probe. The percent difference that is measured by the auditor's monitor is compared to the station monitor. The auditor also assesses station and monitoring siting criteria. The USEPA auditor provides the AMU with a copy of the audit results and uploads the audit data to AQS.

Plans for the 2019 Ozone Monitoring Network

Beginning October 1, 2009, the MDEQ began collecting ozone measurements all year at the NCore sites and plans to continue through 2019:

- Grand Rapids–Monroe St. (260810020); and
- Allen Park (261630001).

To support NSR modeling projects, the MDEQ will continue to collect ozone measurements all year through 2019:

- Lansing (260650018); and
- Houghton Lake (261130001).

The current ozone network meets the minimum design specifications in 40 CFR Part 58. No ozone site reductions are planned at this time. The following monitors are planned to be retained as part of the 2019 ozone network, operating March 1 through October 31:

- Holland (260050003)
- Frankfort/Benzonia (260190003)
- Coloma (260210014)
- Cassopolis (260270003)
- Rose Lake 2 (260370002)
- Flint (260490021)
- Otisville (260492001)
- Harbor Beach (260630007) (downwind monitor)
- Kalamazoo (260770008)
- Evans (260810022)
- Tecumseh (260910007) (background monitor)
- New Haven (260990009)
- Warren (260991003)
- Scottville (261050007)
- Muskegon–Green Creek Rd. (261210039)
- Oak Park (261250001)
- Jenison (261390005)
- Port Huron (261470005)
- Seney (261530001)
- Ypsilanti (261610008)
- Detroit-E 7 Mile (261630019)

To the best of our knowledge, these tribal monitors will also continue to operate in 2019:

- Manistee (261050922) (tribal monitor); and
- Sault Ste. Marie (260330901) (tribal monitor).

$PM_{2.5}$ MONITORING NETWORK

The January 15, 2013, revision to the PM NAAQS lowered the $PM_{2.5}$ annual average from 15.0 µg/m^3 to 12.0 µg/m^3. All sites in Michigan are currently meeting this standard.

The October 17, 2006 changes to the monitoring regulations impacted the minimum number of $PM_{2.5}$ sites in an MSA, as shown in **Table 13**.[7] Background and transport monitors are required in addition to these minimum requirements.

Although speciation monitoring is required, details specifying the exact number of sites and their sampling frequency were not stated in the October 17, 2006 regulations. However, the continued operation of the speciation trends site Allen Park (261630001) on a once every three day sampling schedule is required.

Michigan does not spatially average $PM_{2.5}$ values from multiple sites to determine attainment with the annual $PM_{2.5}$ NAAQS. Therefore, if a $PM_{2.5}$ monitor that is violating the NAAQS must be removed due to loss of access or funding, a replacement site need not be found, if the annual and/or 24-hour design value site(s) in that MSA are still operational. The attainment status of the area is dependent upon the design value sites.

Table 12: $PM_{2.5}$ Minimum Monitoring Requirements

MSA Population[1,2]	Most Recent 3-year Design Value Concentrations ≥ 85% of any $PM_{2.5}$ NAAQS[3]	Most Recent 3-year Design Value Concentrations < 85% of any $PM_{2.5}$ NAAQS[3,4]
> 1,000,000	3	2
500,000 – < 1,000,000	2	1
50,000 - ≤ 500,000[5]	1	0

[1] Minimum monitoring requirements apply to the MSA.
[2] Population based on the latest available census figures.
[3] The $PM_{2.5}$ NAAQS levels and forms are defined in 40 CFR Part 50.
[4] These minimum monitoring requirements apply in the absence of a design value.
[5] MSA must contain an urbanized area of 50,000 or more.

The regulations also state that any Federal Reference Method (FRM) monitors that are within ± 5% of the level of the 24-hour NAAQS must sample on a daily sampling frequency. The monitoring regulations also state that 50% of all required FRM sites must co-locate continuous $PM_{2.5}$ measurements.

In 2016, the MDEQ changed all FRM monitors to very sharp cut cyclones. The change outs were made in April and May 2016. This changed the method code from 118 to 145. The dates of each instrument conversion can be determined by the data in the USEPA AQS database.

During 2018, the MDEQ will begin to make a method change for sampling of $PM_{2.5}$ in its network. A slow transition from the filter-based $PM_{2.5}$ FRM network to a continuous beta attenuation air monitor (BAM) network will be made. The following sites will shut down the FRM filter-based instruments and operate as continuous FEMs:

- Flint (260490021) will be a co-located site with a primary BAM(MetOne) and a secondary $PM_{2.5}$ filter FRM;

[7] Table D-5 of Appendix D to Part 58.

- SWHS (261630015) will be a co-located site with a primary $PM_{2.5}$ filter FRM and a secondary BAM (MetOne);
- Seney (261530001);
- Houghton Lake (261130001); and
- Tecumseh (260910007).

Applying **Table 12** to Michigan's MSAs, the resulting population totals and most recent 3-year design values are presented in **Table 13**. Design values shown in bold print represent the controlling site in each MSA, which is also called the design value site.

Table 13: Application of the Minimum $PM_{2.5}$ Monitoring Requirements in the October 17, 2006 Final Revision to the Monitoring Regulation to Michigan's $PM_{2.5}$ FRM Network

The annual avg & 24-hr avg are rounded to 1 and 0 decimal points respectively.

annual	24-hr	**5% of the 24-Hr NAAQS**
85% of 12 ug/m3	85% of 35 ug /m3	33-37 = 5% NAAQS
10.2	30	

The 3-year PM2.5 annual average at MSA Design Value site is shown in bold.

MSA	2015 Population Est.	Counties	Existing Monitors	2015-2017 3-year PM2.5 design value (annual)	2015-2017 3-year PM2.5 design value (24-Hr)	Min. No. monitors Required	Comments
Detroit-Warren-Livonia MSA	4,313,002	Macomb	New Haven	8.2	23	3	
		Oakland	Oak Park	8.5	23		
		Wayne	Allen Park	9.0	22		daily
			Detroit-SW HS	**11.2**	**22**		
			Detroit - Linwood	9.4	25		
			Detroit - E 7 Mi	8.6	21		
			Livonia	8.5	22		
			Dearborn	10.9	26		
			Wyandotte	7.8	20		
			Detroit-FIA/Lafayette	8.5	21		
			Livonia Near Road	8.8	21.9		
		Lapeer	---				
		St Clair	Port Huron	8.4	22		
		Livingston	---				
Flint MSA	407,385	Genesee	Flint	**7.5**	**19**	**0**	
Monroe MSA	149,649	Monroe	Sterling State Park	**8.2**	**22**	**0**	
Ann Arbor MSA	367,627	Washtenaw	Ypsilanti	**8.4**	**21**	**0**	
Grand Rapids-Wyoming MSA	1,059,113	Kent	GR - Monroe St.	8.5	23	**2**	
			GR - Wealthy St.	**9.1**	**25**		
		Barry	---				
		Ottawa	Jenison (closed)				
		Montcalm	---				
Muskegon-Norton Shores MSA	173,693	Muskegon	Muskegon - Apple St. (closed)			**0**	
Lansing-East Lansing MSA	477,,656	Clinton	---				
		Ingham	Lansing	**7.7**	**20**	**0**	
		Eaton	---				
Bay City MSA	104,239	Bay	Bay City	**7.1**	**22**	**0**	
Kalamazoo-Portage MSA	338,338	Kalamazoo	Kalamazoo	**8.3**	**22**	**0**	
		Van Buren	---				
Niles-Benton Harbor MSA	154,259	Berrien	Coloma	**7.8**	**21**	**0**	
Jackson MSA	158,640	Jackson	---				
Battle Creek MSA	134,128	Calhoun	---				
South Bend-Mishawaka MSA	321,815	Cass	---				
		St. Joseph, IN	0				
Other areas							
		Allegan	Holland	7.5	21		*micropolitan area*
		Missaukee	Houghton Lake	5.1	15		
		Manistee	Manistee	5.9	17		
		Tecumseh	Lenawee	7.8	19		
		Sault Ste. Marie	Chippewa	5.6	17		

The reduced concentrations of $PM_{2.5}$ measured since 2010 have caused the 2015-2017 design values to drop markedly in many MSAs. The minimum number of monitoring sites in Monroe, Ann Arbor, Holland-Grand Haven, Muskegon-Norton Shores, Lansing-East Lansing, Bay City, Kalamazoo-Portage, Flint, and Niles-Benton Harbor has fallen from one site to zero. Due to an increase in population, two monitors sites are again required in the Grand Rapids-Wyoming MSA. Those monitors are located at the Grand Rapids-Monroe St. site (260810020) and the Jenison site (261390005).

Only three $PM_{2.5}$ FRM monitors are required in the Detroit-Warren-Livonia MSA. Dearborn (261630033) has historically been the highest annual design value site; however, this year Detroit-SWHS (261630015) is the highest. Allen Park (261630001) is the population-oriented trend site, and as such, is also required to collect speciated $PM_{2.5}$ samples on a once every three day schedule.

The Wyandotte site (261630036) has the lowest design values in Wayne County. The Linwood site (261630016) also has a low design value and is located in Wayne County between the Dearborn (261630033) and E 7 Mile (261630019) sites. The MDEQ plans to shut down the Wyandotte and Linwood sites.

The Detroit-SWHS site (261630015) is the highest in the Detroit-Warren-Livonia MSA. With construction of the second international bridge crossing near this site, the MDEQ will continue operating the primary $PM_{2.5}$ FRM monitor and will add a $PM_{2.5}$ BAM FEM monitor as part of the Gordie Howe International Bridge monitoring effort.

Detroit–FIA/Lafayette (261630039) was a special purpose monitor that has been located to measure impacts from diesel-powered mobile sources and from the international border crossing at the Ambassador Bridge. This site will be shut down in June 2018 due to a loss of site access. Since the MDEQ is adding three new FEM BAM sites near this site, there are no plans to replace it.

The E 7 Mile site (261630019) is near the border of Wayne and Macomb Counties. The MDEQ will continue to operate this site.

The sites at New Haven (260990009) and Oak Park (261250001) are the only sites in Macomb and Oakland Counties, respectively. The MDEQ will continue to operate these.

The Livonia site (261630025) and the Livonia Near-road site (261630095) are in western Wayne County. The Livonia Near-road site (261630095) fulfills the requirement for $PM_{2.5}$ monitoring at a near-road site. Since values at the Livonia Site (261630025) have been rapidly decreasing and the Livonia Near-road site is only 450 feet away, the MDEQ is planning to discontinue the original Livonia site (261630025).

Through a cooperative grant project with USEPA Region 5 and the USEPA's Office of Research and Development (ORD), the MDEQ deployed a special purpose $PM_{2.5}$ FRM sampler to Tecumseh (260910007) in Lenawee County on April 1, 2008. Other special measurements that were added to the Tecumseh site include $PM_{2.5}$ speciation and continuous EC/OC. Beginning January 1, 2019, the MDEQ will discontinue the two types of speciation monitors. In addition, the MDEQ will change the method of the $PM_{2.5}$ collection, to a continuous FEM method, by installing a BAM FEM monitor sometime in 2018. Tecumseh is the upwind background site near the Detroit-Warren-Livonia MSA where $PM_{2.5}$ measurements will continue.

Two monitors were required in the Grand Rapids-Wyoming MSA. The Grand Rapids-Monroe St. (260810020) is an NCore site and is therefore required to retain the $PM_{2.5}$ monitor, and as such is also required to collect speciated $PM_{2.5}$ samples on a once every three day schedule. The second site is located at the Jenison (261390005) site.

As shown in **Table 13**, using the most recent three years of data, the Flint (260490021) monitor has an annual and a 24-hour design value equaling 7.5 and 19 $\mu g/m^3$, respectively. Both of these values are less than 85% of their respective NAAQS. Therefore, a $PM_{2.5}$ monitoring site is no longer required in the Flint MSA. However, no changes are suggested at this time other than the addition of a continuous FEM BAM to be added in 2018. The BAM will be the primary monitor at this site and the FRM will be the co-located monitor. This will fulfill the requirement to have a BAM co-located with an FRM in the PQAO.

Fine particulate concentrations have dropped below 85% of the level of the NAAQS in the Ann Arbor MSA, so a monitor is no longer required. The Ypsilanti site (261610008) is located in a ZIP code with some of the highest incidences of asthma in Michigan. A co-located monitor is also located at this site to determine precision. No changes are suggested at this time.

The annual and 24-hour $PM_{2.5}$ design values at the Lansing monitor (260650012) are no longer greater than 85% of the NAAQS, indicating that monitoring is no longer required. The MDEQ will continue to operate the monitor at the newly relocated site, Lansing Filley (260650018) which was moved in May 2018.

The Saginaw MSA is required to have a $PM_{2.5}$ FRM site. The USEPA Regional Administrator granted a waiver allowing for the Bay City site (260170014) to fulfill this requirement. The 24-hour $PM_{2.5}$ design value of the monitor in Bay City is less than 85% of the NAAQS, indicating that monitoring is no longer required. The MDEQ will continue to operate the monitor.

The Kalamazoo monitor (260770008) fulfilled the requirement that the Kalamazoo-Portage MSA have one FRM sampler. Both the most recent 24-hour and annual design value at the Kalamazoo monitor are now less than 85% of the respective NAAQS, indicating that a site is no longer necessary in this MSA. The MDEQ will discontinue operation of both FRM monitors and replace them with co-located continuous FEM BAM in 2018. If the MDEQ installs enough BAM monitors in 2018 to require a BAM to BAM co-location, a second FEM BAM will be installed at this site.

The $PM_{2.5}$ monitor in Holland (260050003) in Allegan County is in a micropolitan area. The monitor's design value is no longer within 85% of the NAAQS. Now that concentrations have fallen, it may be possible to discontinue monitoring at Holland, but the MDEQ will continue to operate the monitor.

Houghton Lake (261130001) is the background $PM_{2.5}$ FRM site in Michigan. The MDEQ plans to replace this monitor with a continuous FEM BAM in 2018.

There are two tribal $PM_{2.5}$ monitoring sites located in Michigan; one in Manistee (261010922) operated as a FRM filter-based sampler, and the other is in Sault Ste. Marie (260330901). It operates as a continuous FEM BAM. It is anticipated that both sites will continue to sample for $PM_{2.5}$.

Table 14 summarizes the $PM_{2.5}$ FRM monitoring site information for 2018 and 2019. **Figure 7** illustrates the geographical distribution of $PM_{2.5}$ FRM monitors for 2018 and 2019.

Table 14: Michigan's $PM_{2.5}$ FRM Network

Operating Schedule: Once every 6 days, once every 3 days or daily see below.
Method: Partisol 2025 Rupprecht & Patashnick Samplers, Method Code 145

SLAMS Network

Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Sampling Frequency	Purpose/ Type	Parameter Code	POC	Scale	County	Start Date	MSA [1]	Pop (2015 Estimate)
Holland	260050003	966 W. 32nd, Holland	42.767778	-86.148611	1:3	Pop. Exp.	88101	1	Neighborhood	Allegan	10/31/98	A	116,447
Bay City	260170014	1001 Jennison St	43.571389	-83.890833	1:3	Pop. Exp.	88101	1	Neighborhood	Bay	8/24/00	BC	104,239
Flint	260490021	3610 Iowa St., Flint	43.04722	-83.670278	1:6, co-loc	Pop. Exp.	88101	2	Neighborhood	Genesee	12/16/98	F	407,385
Lansing Filley	260650018	815 Filley St	42.761654	-84.562879	1:3	Pop. Exp.	88101	1	Neighborhood	Ingham	5/17/18	LEL	477,656
Grand Rapids - Monroe St.	260810020	1179 Monroe St., NW,	42.984167	-85.671389	1:3	Pop. Exp.	88101	1	Neighborhood	Kent	10/23/98	GW	1,059,113
Grand Rapids - Monroe St.	260810020	1179 Monroe St., NW,	42.984167	-85.671389	1:6, coloc	Pop. Exp.	88101	2	Neighborhood	Kent	10/23/98	GW	1,059,113
New Haven	260990009	57700 Gratiott	42.731389	-82.793611	1:3	Pop. Exp.	88101	1	Neighborhood	Macomb	12/22/98	DWL	4,313,002
Oak Park	261250001	13701 Oak Park Blvd.	42.463056	-83.183333	1:3	Pop. Exp.	88101	1	Neighborhood	Oakland	12/25/98	DWL	4,313,002
Jenison	261390005	6981 28th Ave	42.894402	-85.85278	1:6	Pop. Exp.	88101	1	urban	Ottawa	1/2/18	GW	1,059,113
Port Huron	261470005	2525 Dove Rd.	42.953333	-82.456389	1:3	Pop. Exp.	88101	1	Urban	Saint Clair	2/11/99	DWL	4,313,002
Ypsilanti	261610008	555 Towner Ave.	42.240556	-83.599722	1:3	Pop. Exp.	88101	1	Neighborhood	Washtenaw	8/4/99	AA	367,627
Ypsilanti	261610008	555 Towner Ave.	42.240556	-83.599722	1:6, co-loc	Pop. Exp.	88101	2	Neighborhood	Washtenaw	8/4/99	AA	367,627
Allen Park	261630001	14700 Goddard	42.228611	-83.208333	1:1	Pop. Exp.	88101	1	Neighborhood	Wayne	5/12/99	DWL	4,313,002
Detroit - SWHS	261630015	150 Waterman	42.302778	-83.106667	1:3	Pop. Exp. Max. Conc.	88101	1	Neighborhood	Wayne	2/26/99	DWL	4,313,002
Detroit - E 7 Mile	261630019	11600 E. 7 Mile	42.430833	-83.000278	1:3	Pop. Exp.	88101	1	Neighborhood	Wayne	4/30/00	DWL	4,313,002
Livonia Near Road	261630095	18790 Haggerty Rd.	42.421494	-83.425168	1:3	Near Road	88101	1	Micro	Wayne	1/1/15	DWL	4,313,002
Dearborn	261630033	2842 Wyoming, Salina School	42.306666	-83.148889	1:3	Pop. Exp. Max. Conc.	88101	1	Neighborhood	Wayne	2/5/99	DWL	4,313,002
Dearborn	261630033	2842 Wyoming, Salina School	42.306666	-83.148889	1:6, co-loc	Pop. Exp. Max. Conc.	88101	2	Neighborhood	Wayne	2/5/99	DWL	4,313,002

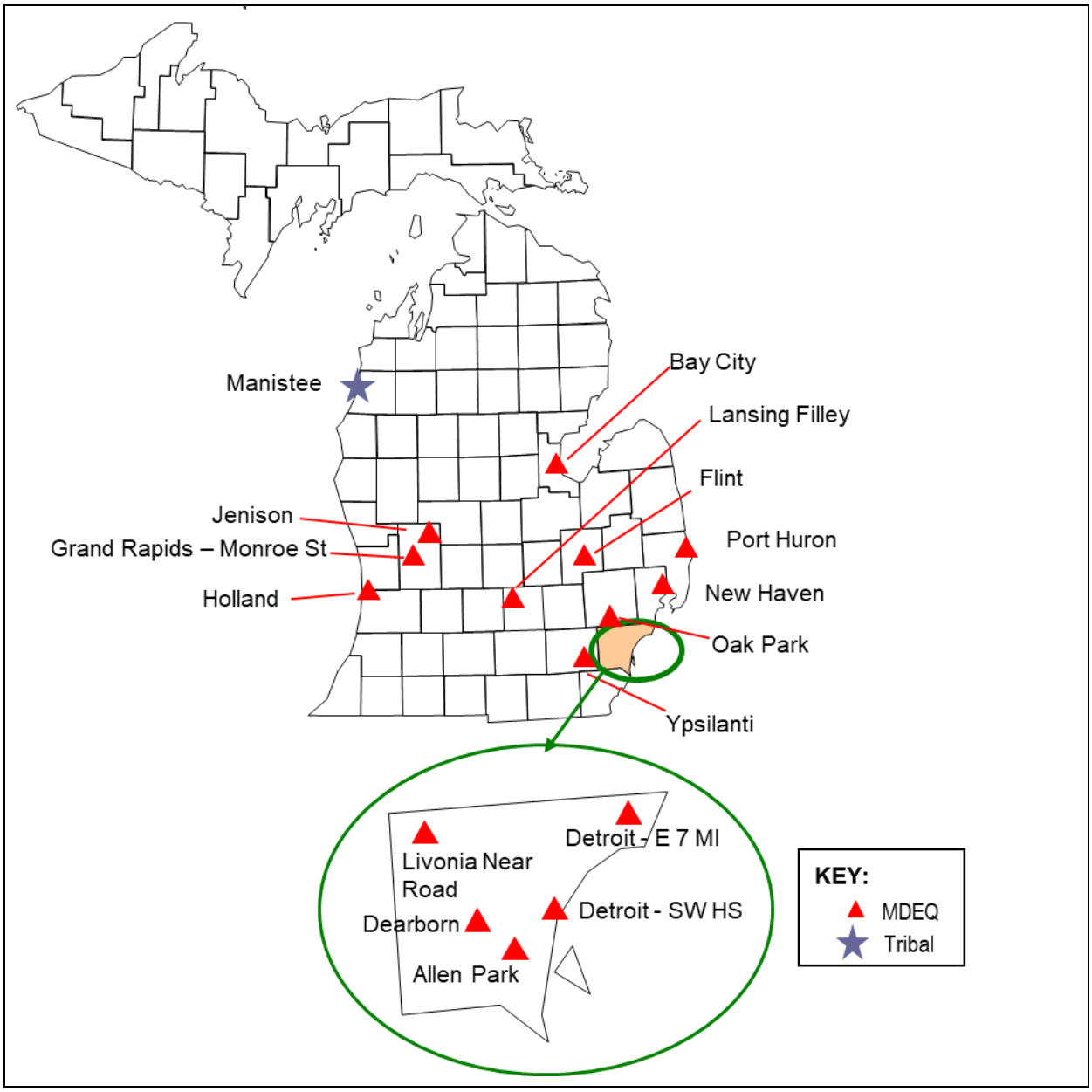
Special Purpose and Tribal $PM_{2.5}$ Monitors in Michigan

Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Sampling Frequency	Purpose/ Type	Parameter Code	POC	Scale	County	Start Date	MSA [1]	Pop (2015 Estimate)
Manistee	261010922	3031 Domres Rd.	44.307	-86.24268	1:3	Tribal	88101	1	Regional	Manistee	4/2/06	Not in CBSA	N/A

[1] MSA Key:

A = Allegan Micropolitan Area
AA = Ann Arbor MSA
AL = Adrian Micropolitan Area
DWL = Detroit-Warren-Livonia MSA
F = Flint MSA
GW = Grand Rapids-Wyoming MSA
HGH = Holland-Grand Haven MSA
KP = Kalamazoo-Portage MSA
LEL = Lansing-E. Lansing MSA
M = Monroe MSA
MNS = Muskegon-Norton Shores MSA
NBH = Niles-Benton Harbor MSA
SBM = South Bend-Mishawaka MSA (IN/MI)

Figure 7: Michigan's $PM_{2.5}$ FRM Monitoring Network



$PM_{2.5}$ Quality Assurance

The $PM_{2.5}$ sampling is addressed in the AMU's program QAPP. The MDEQ operates four co-located $PM_{2.5}$ FRM samplers, meeting the precision monitoring requirement of 15%. The sampling frequency of the precision samplers at Grand Rapids–Monroe St. (260810020), Kalamazoo (260770008), Ypsilanti (261610008), and Dearborn (261630033) is once every six days. As the network is converted over to FEM BAM, the co-location sites will be adjusted.

The MDEQ's station operators conduct flow checks every four weeks to ensure the flow rate is meeting the measurement quality objectives. Results from these flow checks are submitted to the $PM_{2.5}$ auditor each month for review and are uploaded to the USEPA's AQS database each quarter. Every six months, each $PM_{2.5}$ sampler is audited by a member of the AMU's QA Team. The auditor has a separate line of supervision from the site operator and uses dedicated equipment for audits. The audit assesses the accuracy of the flow, as well as the monitor sampling and siting criteria. Every flow audit is reviewed by the QA Coordinator, copies are retained in the QA files, and the audits are uploaded to the USEPA's AQS database. The AMU's auditor also performs a systems audit for each sampler. The systems audit evaluates the siting criteria, condition of the sampling site/station, and other parameters. Copies of the systems audit forms are reviewed by the QA Coordinator and are retained in the QA central files.

The MDEQ participates in the USEPA's Performance Evaluation Program (PEP) audits at eight sites each year. The USEPA auditor sets up a $PM_{2.5}$ monitor to run side-by-side with the station $PM_{2.5}$ sampler on a run day. The filter from the PEP audit is sent to an independent laboratory for analysis. Once the MDEQ filter weight is entered into the USEPA's AQS database, the audit filter weight is entered by the USEPA whereby the concentrations are compared between the PEP audit filter and the station filter. The USEPA auditor also assesses the station and monitor siting criteria to evaluate adequacy of the location, including distances from trees, exhaust vents, and large buildings. Probe heights and separation distances are also assessed.

Plans for the 2018-2019 $PM_{2.5}$ FRM Monitoring Network

The following $PM_{2.5}$ FRM monitors will be retained as part of the 2019 network:

- The one in three day $PM_{2.5}$ FRM monitor in Holland (260050003)
- The one in three day $PM_{2.5}$ FRM monitor in Bay City (260170014)
- The one in three day $PM_{2.5}$ FRM monitor in Lansing (260650018)
- The one in three day $PM_{2.5}$ FRM monitor in Grand Rapids-Monroe St. (260810020)
- The one in three day $PM_{2.5}$ FRM monitor in Jenison (261390005)
- The one in three day $PM_{2.5}$ FRM monitor in New Haven (260990009)
- The one in three day $PM_{2.5}$ FRM monitor in Oak Park (261250001)
- The one in three day $PM_{2.5}$ FRM monitor in Port Huron (261470005)
- The one in three day $PM_{2.5}$ FRM monitor in Ypsilanti (261610008)
- The daily $PM_{2.5}$ FRM monitor in Allen Park (261630001)
- The one in three day $PM_{2.5}$ FRM monitor at Detroit-SWHS (261630015)
- The one in three day $PM_{2.5}$ FRM monitor at Detroit-E 7 Mile (261630019)
- The one in three day $PM_{2.5}$ FRM monitor at Livonia-Near-road (261630095)
- The one in three day $PM_{2.5}$ FRM monitor in Dearborn (261630033)

The following co-located precision monitors will continue operation contingent upon adequate funding:

- The one in six day $PM_{2.5}$ FRM monitor at Grand Rapids-Monroe St. (260810020);
- The one in six day $PM_{2.5}$ FRM monitor in Ypsilanti (261610008);
- The one in six day $PM_{2.5}$ FRM monitor in Dearborn (261630033); and
- The one in three day $PM_{2.5}$ FRM monitor in Flint (260490021).

The following $PM_{2.5}$ FRM monitors will be shut down:

- The one in three day $PM_{2.5}$ FRM monitor in Livonia (261630025);
- The one in three day $PM_{2.5}$ FRM monitor in Linwood (261630016);
- The one in three day $PM_{2.5}$ FRM monitor in Wyandotte (261630036); and
- The one in three day $PM_{2.5}$ FRM monitor in FIA (261630039).

The following $PM_{2.5}$ FRM filter-based samplers will be replace with FEM BAM Monitors:

- The one in three day $PM_{2.5}$ FRM monitor in Houghton Lake (261130001);
- The one in three day $PM_{2.5}$ FRM monitor in Tecumseh (260910007).

The following $PM_{2.5}$ continuous FEM BAM monitors will be added to the network:

- Flint (260490021) will be primary to the secondary $PM_{2.5}$ FRM;
- SWHS (261630015) will be secondary to the primary $PM_{2.5}$ FRM; and
- Seney (261530001) replacing the TEOM.

To the best of our knowledge, the following tribal FRM monitors will continue operation:

- A one in three day $PM_{2.5}$ FRM tribal monitoring site in Manistee (261010922), contingent upon the Little River Band of Ottawa Indians plans for 2019.

CONTINUOUS $PM_{2.5}$ MONITORING NETWORK

According to the October 17, 2006, changes to the monitoring regulations, 50% of the minimum number of required FRM sites must be co-located with a continuous $PM_{2.5}$ monitor. The 13 continuous monitors operational in the state exceed the minimum number that are required.

In 2018, the MDEQ operated Rupprecht & Patashnick TEOM samplers to supply continuous fine particulate data at 13 monitoring sites, as shown in **Table 15**. The MDEQ currently is meeting the minimum 50% co-location requirement. **Figure 8** illustrates the geographical distribution of the continuous monitoring network.

Michigan's NCore stations are required to operate continuous $PM_{2.5}$ samplers. Both Grand Rapids–Monroe St. (260810020) and Allen Park (261630001) currently have $PM_{2.5}$ TEOMs, meeting the requirement for continuous $PM_{2.5}$ measurements.

The MetOne BAM operated by the Inter-Tribal Council, Sault Ste. Marie (260330901), is currently operated as an FEM and can be compared to the NAAQS.

In 2018, the MDEQ will make a method change for sampling of $PM_{2.5}$ at some of the sites as seen below. A slow transition from the filter-based $PM_{2.5}$ FRM network to a BAM network will be made. The instruments will operate as continuous FEMs. The FEM BAMs will also replace the TEOM instruments as the MDEQ is able to purchase new instruments.

The MDEQ operates the TEOMs from March through October with an inlet temperature of 50°C. Once the ozone season is over, starting November 1, the MDEQ reduces the inlet temperature to 30°C in the winter months to minimize loss of nitrates. Operating the TEOMs in this way maximizes comparability with the FRMs. The $PM_{2.5}$ TEOM sites operate to support AIRNOW real time data reporting and to provide adequate spatial coverage. This will continue as long as adequate levels of funding are received.

Table 15: Michigan's Continuous $PM_{2.5}$ Monitoring Network

Operating Schedule: continuous

Method: Rupprecht & Patashnick Tapered Element Oscilating Microbalance (TEOMS) Samplers, Method Codes 701/703

Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Purpose/ Type	Parameter Code	POC	Scale	County	Start Date	MSA [1]	Pop (2015 Estimate)
Bay City	260170014	1001 Jennison St	43.571389	-83.890833	Pop. Exp.	88503	3	Neighborhood	Bay	11/19/05	BC	104,239
Lasing Filley	260650018	815 Filley Street	42.761654	-84.562879	Pop. Exp.	88101	1	Neighborhood	Ingham	5/17/18	LEL	477,656
Grand Rapids - Monroe St	260810020	1179 Monroe St., NW,	42.984167	-85.671389	Pop. Exp.	88503	3	Neighborhood	Kent	11/4/99	GW	1,059,113
Port Huron	261470005	2525 Dove Rd.	42.953333	-82.456389	Pop. Exp.	88503	3	Regional	Saint Clair	9/18/03	DWL	4,313,002
Ypsilanti	261610008	555 Tow ner Ave	42.240556	-83.599722	Pop. Exp.	88503	3	Neighborhood	Washtenaw	2/24/00	AA	367627
Allen Park	261630001	14700 Goddard	42.228611	-83.208333	Pop. Exp.	88503	3	Neighborhood	Wayne	12/1/00	DWL	4,313,002
Dearborn	261630033	2842 Wyoming, Salina School	42.306666	-83.148889	Pop. Exp. Max. Conc.	88503	3	Neighborhood	Wayne	9/26/03	DWL	4,313,002

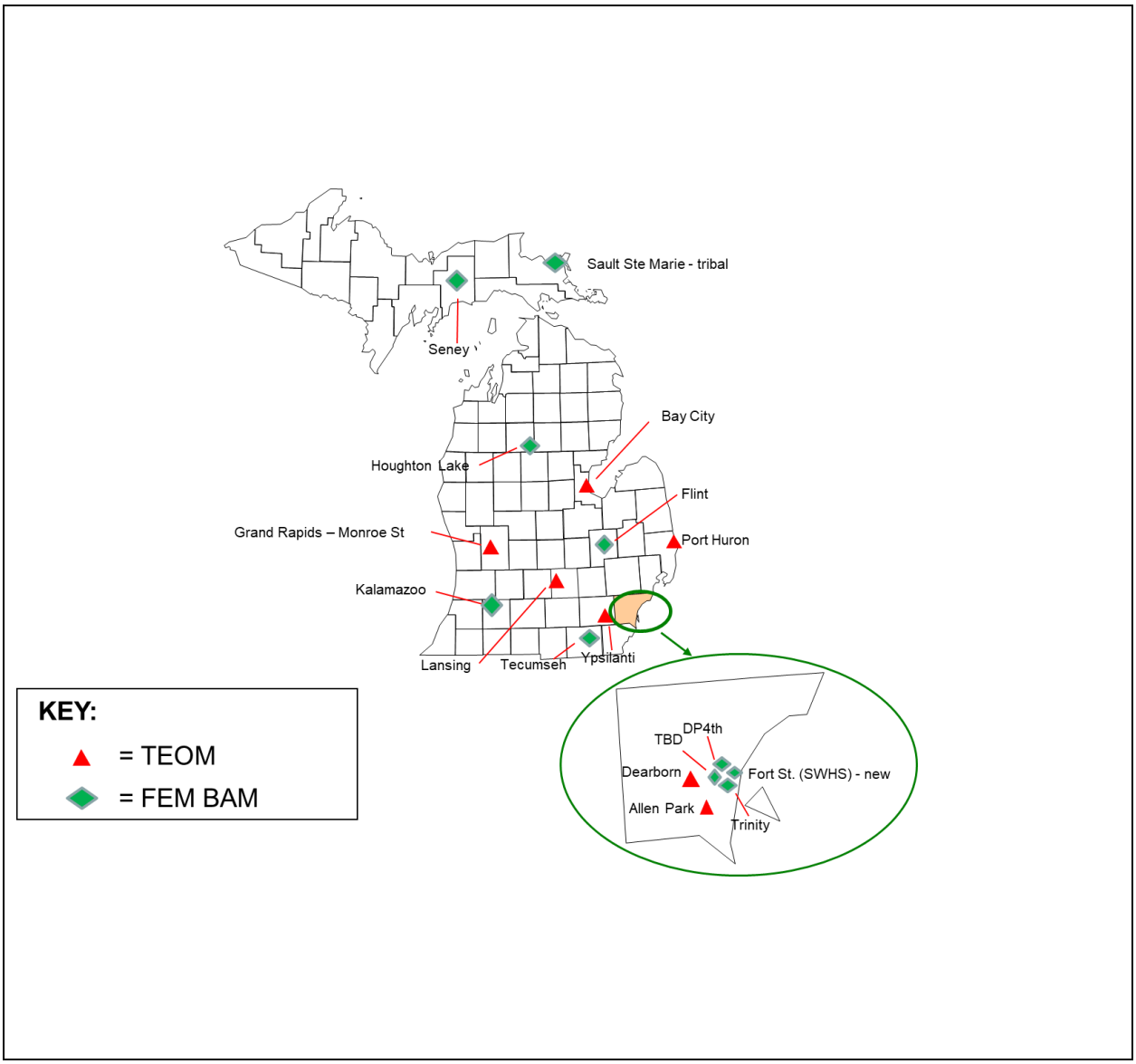
Method: Beta Attenuation Monitor, Method Code 170

Sault Ste. Marie	260330901	650 W Easterday Ave	46.49366	-84.36416	Tribal	88101	3	Regional	Chippew a	1/1/2012	Not in MSA	N/A
Flint	260490021	Whaley Park, 3610 Iow a St., Flint	43.04722	-83.670278	Pop. Exp.	88101	1	Neighborhood	Genesee	TBD	F	407,385
Kalamazoo	260770008	Fairgrounds, 1400 Olmstead Rd.	42.278056	-85.541944	Pop. Exp.	88101	2	Neighborhood	Kalamazoo	TBD	KP	338,338
Kalamazoo. Co-located	260770008	Fairgrounds, 1400 Olmstead Rd.	42.278056	-85.541944	Pop. Exp.	88101	3	Neighborhood	Kalamazoo	TBD	KP	338,338
Tecumseh	260910007	6792 Raisin Center Highw ay	41.995556	-83.946667	up w ind backgrd	88101	1	Regional	Lenaw ee	TBD	AL	98623
Houghton Lake	261130001	1769 S Jeffs Rd.	44.310556	-84.891944	Background	88101	1	Regional	Missaukee	TBD	Not in MSA	N/A
Seney	261530001	Seney Wildlife Refuge, HCR 2 Box 1	46.28888	-85.95027	Background	88101	1	Regional	Schoolcraft	TBD	Not in MSA	N/A
SWHS	261630015	150 Waterman , Detroit	42.302778	-83.106667	Pop. Exp.	88101	1	Neighborhood	Wayne	TBD	DWL	4,313,002
DP4TH	261630098	4700 W.Fort St.	42.312158	-83.091943	Pop. Exp.	88101	1	Neighborhood	Wayne	TBD	DWL	4,313,002
Trinity	261630099	9191 W Fort St.	42.295824	-83.129431	Pop. Exp.	88101	1	Neighborhood	Wayne	TBD	DWL	4,313,002
TBD	261630100				Pop. Exp.	88101	1	Neighborhood	Wayne	TBD	DWL	4,313,002

[1] MSA Key:

AA = Ann Arbor MSA
AL = Adrian Micropolitan Area
BC = Bay City MSA
DWL = Detroit-Warren-Livonia MSA
F = Flint MSA F = Flint MS F = Flint MSA
GW = Grand R GW = Grand GW = Grand Rapids-Wyoming MSA
KP = Kalamaz KP = Kalam KP = Kalamazoo-Portage MSA
LEL = Lansing- LEL = Lansi LEL = Lansing-E. Lansing MSA

Figure 8: Michigan's Continuous $PM_{2.5}$ Network



Continuous $PM_{2.5}$ TEOM and FEM BAMs Quality Assurance

The AMU site operator conducts flow checks for precision every four weeks. Results from the precision checks are sent to the auditor for review each month and reported to the USEPA's AQS database each quarter. An independent flow rate audit is conducted by a member of the AMU's QA Team every six months. During the flow rate audit, the auditor assesses the condition of the station, sample probe, and siting criteria. The QA Coordinator reviews all audit results and hard copies of the results are retained in the QA files. Each quarter the flow audits are uploaded to the USEPA's AQS database.

Plans for the 2019 Continuous $PM_{2.5}$ TEOM and FEM BAMs Network

There is one addition planned for the $PM_{2.5}$ TEOM network, but if the USEPA cuts funding, operation of some additional TEOMs may need to be discontinued. Continued operation of the $PM_{2.5}$ TEOMs at Dearborn (261630033), Allen Park (261630001), and Grand Rapids-Monroe St. (260610020) will be given the highest priority. The Dearborn (261630033) monitor measures the highest concentrations of $PM_{2.5}$ in Michigan and is needed for the development of attainment strategies, AIRNOW reporting, diurnal profiling and estimation of risk. The Allen Park (261630001) monitor is needed to provide a counterpoint to the measurements taken at Dearborn. Allen Park is a population-oriented site designated as the trend site for Michigan. Dearborn is the maximum concentration site, so comparisons between these sites are important to characterize point source impacts on ambient air quality. Also, the $PM_{2.5}$ TEOMs at Grand Rapids-Monroe St. (260810020) and Allen Park (261630001) need to continue operation due to the NCore requirement for continuous fine particulate measurements.

During 2019, contingent upon adequate levels of funding, Michigan is planning to continue to operate $PM_{2.5}$ TEOM monitors at:

- Bay City (260170014)
- Grand Rapids–Monroe St. (260810020)
- Port Huron (261470005)
- Ypsilanti (261610008)
- Allen Park (261630001)
- Dearborn (261630033)
- Lansing (260650018)
- Kalamazoo (260770008)

During 2018, contingent upon adequate levels of funding, Michigan plans to install continuous $PM_{2.5}$ FEM BAM monitors at:

- Flint (260490021) will be a co-located site with a primary BAM (MetOne) and a secondary $PM_{2.5}$ filter FRM
- SWHS (261630015) will be a co-located site with a primary $PM_{2.5}$ filter FRM and a secondary BAM (MetOne)
- Seney (261530001)
- Houghton Lake (261130001)
- Tecumseh (260910007)
- DP4th (261630098)
- Trinity (261630099)
- TBD (261630100)

During June 2018, due to loss of site access the TEOM at FIA (261630039) will be shutdown.

During 2019, to the best of our knowledge, the Inter-Tribal Council is planning to continue to operate as an FEM a $PM_{2.5}$ BAM MetOne monitor at Sault Ste. Marie (260330901).

SPECIATED $PM_{2.5}$ MONITORING NETWORK

Continued operation of the speciation trend site network is required on a national level and these sites sample on frequency of once every three days, following the USEPA sampling schedule. The speciated trend site in Michigan is located at Allen Park (261630001). All remaining supplemental speciation sites operate on a once every six day schedule, except for the NCore site at Grand Rapids–Monroe St. (260810020), which also has a sampling frequency of once every three days. Tecumseh (260910007) was a special purpose monitor for a study, which is now complete, and will be shut down in 2019. The speciation network is described in **Table 16**. **Figure 9** illustrates the current coverage across Michigan.

Note that Allen Park (261630001) contains a suite of carbon channel samplers: an IMPROVE, a MetOne SASS and an URG 3000 N. The MDEQ will continue to operate the three different carbon samplers to support USEPA OAQPS inter-sampler comparability studies.

Continuous Speciation Measurements

In addition to the speciated measurements integrated over a 24-hour time period described above, The MDEQ operates continuous monitors for carbon black and elemental carbon/organic carbon (EC/OC). Large spot aethalometers from Magee Scientific operate at Dearborn (261630033) and Allen Park (261630001). These units measure carbon black, which is very similar to and correlates well with elemental carbon. As part of the CSATAM 2015 grant, three new aethalometers were purchased from Magee Scientific. These were installed in 2016 as Special Purpose Monitors at Eliza Howell Near-road (261630093), Eliza Howell Downwind (261630094), and Livonia Near-road (261630095). Since the Air Toxics Near-roadway study has been completed, these instruments will be relocated to the three new Gordie Howe International Bridge monitoring locations and one newly purchased monitor will be installed at the southwest Detroit site.

A continuous EC/OC monitor from Sunset Laboratories was deployed at the Detroit-Newberry site (261630038) site to determine diurnal variation in elemental carbon and organic carbon. This EC/OC is currently on reserve as a backup due to the loss of site access at Detroit-Newberry. To help in the development of attainment strategies, the Southeast Michigan Council of Governments (SEMCOG) purchased a second Sunset EC/OC unit that was deployed at Dearborn (261630033). The instrument at Dearborn became non-functional in February 2018. An additional EC/OC unit was deployed at Tecumseh (260910007) to characterize levels upwind from Detroit. This will be shut down sometime in 2018 due to the cost of replacement parts, age of the equipment, and the frequency of repairs.

Speciation Quality Assurance

The MDEQ has adopted and follows the USEPA's QAPP for the speciation trends network. The site operator conducts flow checks for precision every four weeks. Results from the precision checks are sent to the auditor for review each month and uploaded to the USEPA's AQS database each quarter. The QA team conducts flow rate audits on the $PM_{2.5}$ speciation monitors every six months. The auditor also assesses the monitoring station and siting criteria to ensure it continues to meet the measurement quality objectives. Audit results are reviewed by the AMU's QA Coordinator. Audit data is also uploaded to the USEPA's AQS database each quarter. The USEPA periodically conducts technical systems audits and instrument audits for the speciation network. The USEPA also conducts audits of national contract laboratory, which supplies speciation analysis services for the entire nation.

Table 16: Michigan's $PM_{2.5}$ Speciation Network

Current Speciation Sites

Operating Schedule: Once Every 3 days (Allen Park and Grand Rapids), once every 6 days all others. Follows USEPA sampling schedule.

Method: Met One SASS and URG 3000 N units to collect organic & elemental carbon, Method Code 811 (SASS) Method Code 839/840 (URG)

Monitoring Sites													
Site Name	AQS Site ID	Address	Latitude	Longitude	Sampling Frequency	Purpose/ Type	POC	Scale	County	Start Date	MSA [1]	Pop (2015 Estimate)	Comments
Grand Rapids - Monroe St	260810020	1179 Monroe St., NW,	42.984	-85.67139	1:3	Pop. Exp.	5	Neighborhood	Kent	11/4/99	GW	1,038,583	
Allen Park	261630001	14700 Goddard	42.229	-83.20833	1:3	Pop. Exp.	5	Neighborhood	Wayne	12/1/00	DWL	4,302,043	
Fort St. (SWHS)	261630015	150 Waterman St	42.303	-83.10667	1:6	Pop. Exp. Max. Conc.	5	Neighborhood	Wayne	11/2/08	DWL	4,302,043	
Dearborn	261630033	2842 Wyoming, Salina School	42.307	-83.14889	1:6	Pop. Exp. Max. Conc.	5	Neighborhood	Wayne	9/26/03	DWL	4,302,043	

Continuous Speciation Measurements

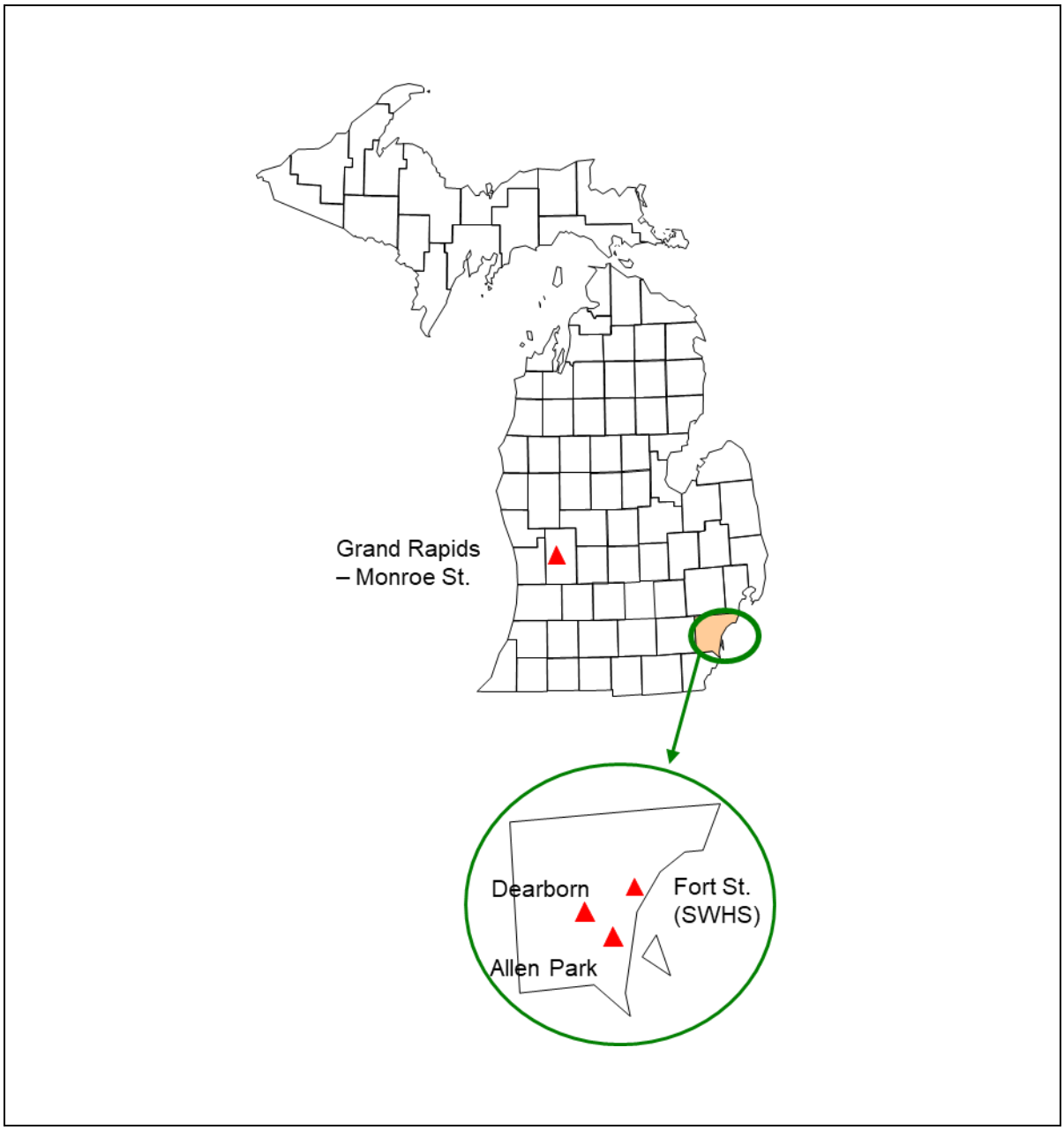
Method: Magee Aethalometer: Method Code 861

Monitoring Sites												
Site Name	AQS Site ID	Address	Latitude	Longitude	Sampling Method	Purpose	POC	Scale	County	Start Date	MSA [1]	Pop (2015 Estimate)	Comments
Allen Park	261630001	14700 Goddard	42.229	-83.20833	McGee large spot Aethalometer (carbon black)	Pop. Exp.	1	Neighborhood	Wayne	1/1/04	DWL	4,302,043	
Dearborn	261630033	2842 Wyoming, Salina School	42.307	-83.14889	McGee large spot Aethalometer (carbon black)	Pop. Exp. Max. Conc.	1	Neighborhood	Wayne	12/19/03	DWL	4,302,043	
Fort St. (SWHS)	261630015	150 Waterman St	42.303	-83.10667	McGee large spot Aethalometer (carbon black)	Pop. Exp. Max. Conc.	1	Neighborhood	Wayne	TBD	DWL	4,302,043	

[1] MSA Key:

DWL = Detroit-Warren-Livonia MSA
GW = Grand Rapids-Wyoming MSA
SPM = Special Purpose Monitor

Figure 9: Michigan's $PM_{2.5}$ Speciation (SASS) Network



Plans for the 2019 $PM_{2.5}$ Speciation Monitoring Network

During 2019, contingent upon adequate levels of funding, the MDEQ is planning to continue to operate 24-hour $PM_{2.5}$ SASS speciation monitors at:

- Grand Rapids-Monroe St. (260810020) operating once every three days;
- Allen Park (261630001) operating once every three days;
- Dearborn (261630033) operating once every six days; and
- SWHS (261630015) operating once every six days.

On January 1, 2019, the MDEQ is planning on shutdown the 24-hour $PM_{2.5}$ SASS speciation monitor at Tecumseh (260910007).

During 2018, the MDEQ is planning to discontinue operating hourly Sunset EC/OC monitors at:

- Dearborn (261630033); and
- Tecumseh (260910007).

During 2019, contingent upon adequate levels of funding, the MDEQ is planning to continue to operate hourly Magee aethalometer monitors at:

- Dearborn (261630033); and
- Allen Park (261630001).

During 2018, the MDEQ is planning on installing hourly Magee aethalometer monitors as part of the Gordie Howe International Bridge monitoring at:

- DP4TH 261630099);
- Trinity (261630099);
- TBD (261630100); and
- SWHS site (261630015).

PM_{10} MONITORING NETWORK

The October 17, 2006 monitoring regulations modified the minimum number of PM_{10} samplers required in MSAs. Since then, further revisions have occurred, relaxing the numbers of sites required in high population areas with low concentrations of PM_{10}, as shown in **Table 17**.[8]

Table 17: PM_{10} Minimum Monitoring Requirements (Number of Stations per MSA)[1]

Population Category	High Concentration[2]	Medium Concentration[3]	Low Concentration[4, 5]
> 1,000,000	6-10	4-8	2-4
500,000 – 1,000,000	4-8	2-4	1-2
250,000 – 500,000	3-4	1-2	0-1
100,000 – 250,000	1-2	0-1	0

1 Selection of urban areas and actual numbers of stations per area within the ranges shown in this table will be jointly determined by the USEPA and the State Agency.
2 High concentration areas are those for which ambient PM_{10} data show ambient concentrations exceeding the PM_{10} NAAQS by 20% or more.
3 Medium concentration areas are those for which ambient PM_{10} data show ambient concentrations exceeding 80% of the PM_{10} NAAQS.
4 Low concentration areas are those for which ambient PM_{10} data show ambient concentrations < 80% of the PM_{10} NAAQS.
5 These minimum monitoring requirements apply in the absence of a design value.

Applying **Table 17** to Michigan's urban areas, population totals and historical PM_{10} data results in the design requirements that are shown in **Table 18**.

According to the tables, two to four PM_{10} sites are required in the Detroit-Warren-Livonia Metropolitan Area. Currently, there are three sites in operation; one at Allen Park (261630001), one at Detroit-SWHS (261630015), and a co-located pair at the design value site at Dearborn (261630033). The co-located PM_{10} samplers at Dearborn fulfilled the 15% co-location requirement for the PM_{10} network.

The PM_{10} monitoring requirements specify that two to four PM_{10} sites are required in the Grand Rapids-Wyoming MSA. There are currently two sites in operation, one at Grand Rapids-Monroe St. (260810020) and the second at Jenison (261390005).

According to the requirements, either zero or one PM_{10} monitor is required in the Flint MSA. In 2006, the MDEQ operated a PM_{10} sampler in Flint (260490021) but as a result of budget cuts, PM_{10} sampling was discontinued on April 1, 2007.

PM coarse measurements are required at NCore sites. One acceptable technology is to use two R & P Partisol Plus 2025 units; one equipped with a $PM_{2.5}$ head and a very sharp cut cyclone and the second with a PM_{10} head and a down tube. PM coarse is determined by subtracting the fine particulate from the PM_{10}. Therefore, to meet the NCore requirements, a Partisol sampler equipped with a PM_{10} head and a down tube was deployed to both Grand Rapids–Monroe St. (260810020) and Allen Park (261630001).

Table 19 summarizes the PM_{10} monitoring site information for sites in operation in 2018 and 2019. **Figure 10** shows the PM_{10} monitoring locations for 2018 and 2019.

8 Table D-4 of Appendix D to Part 58.

Table 18: Application of the Minimum PM_{10} Monitoring Regulations in the April 30, 2007 Correction to the October 17, 2006 Final Revision to the Monitoring Regulation to Michigan's PM_{10} Network

Design value sites are in bold

MSA	2015 Estimated Population	Counties	Existing Monitors	2015-2017 most recent 3-year PM10 design value (24-Hr)	Conc. Class.	Min No monitors Required
Detroit-Warren-Livonia MSA	4,313,002	Macomb	---	**---**		2-4
		Oakland	---	**---**		
		Wayne	Allen Park	37	low	
			Detroit -SW HS	49	low	
			Dearborn	**58**	low	
		Lapeer	---	**---**		
		St Clair	---	**---**		
		Livingston	---	---		
Flint MSA	407,385	Genesee		---	low	0 -1
Monroe MSA	149,649	Monroe	---	**---**		
Ann Arbor MSA	367,627	Washtenaw	---	**---**		0-1
Grand Rapids-Wyoming MSA	1,059,113	Kent	GR - Monroe St	**38**	low	2-4
		Barry	---	---		
		Ottawa	Jenison started 2018	---		
		Montcalm	---	---		
Muskegon-Norton Shores MSA	173,693	Muskegon	---	---		
Lansing-East Lansing MSA	477,656	Clinton	---	---		0-1
		Ingham	---	---		
		Eaton	---	---		
Bay City MSA	104,239	Bay	---	---		
Saginaw-Saginaw Twp N MSA	191,934	Saginaw	---	---		
Kalamazoo-Portage MSA	338,338	Kalamazoo	---	---		0-1
		Van Buren	---	---		
Niles-Benton Harbor MSA	154,259	Berrien	---	---		
Jackson MSA	158,640	Jackson	---	---		
Battle Creek MSA	134,128	Calhoun	---	---		
South Bend-Mishawaka MSA	321,815	Cass	---	---		0-1
		St. Joseph, IN	---	---		

MSAs with populations greater than 500,000 require at least 1 PM 10 monitor.

Table 19: Michigan's PM_{10} Monitoring Network

Method: Manual High Volume Sampler: Method Code 109 (Dearborn also uses a R&P TEOM to make continuous measurements: Method Code 079)

Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Sampling Frequency	Monitor Type	Purpose/ Type	Parameter Code	POC	Scale	County	Start Date	MSA [1]	Pop (2015 Estimate)
Allen Park	261630001	14700 Goddard	42.228611	-83.20833	1:6	High Vol	pop exp	81102	1	nghbrhd	Wayne	9/12/87	DWL	4,313,002
Detroit - SWHS	261630015	150 Waterman	42.302778	-83.10667	1:6	High Vol	max conc	81102	1	nghbrhd	Wayne	3/27/87	DWL	4,313,002
Dearborn	261630033	2842 Wyoming	42.306666	-83.14889	1:6	High Vol	max conc	81102	1	nghbrhd	Wayne	6/12/90	DWL	4,313,002
Grand Rapids - Monroe St	260810020	1179 Monroe NW	42.984167	-85.67139	1:6	High Vol	pop exp	81102	1	nghbrhd	Kent	3/20/87	GW	1,059,113
Jenison	261390005	6981 28Th Ave. Georgetown Twp.	42.894444	-85.85278	1:6	High Vol	pop exp	81102	1	nghbrhd	Ottawa	1/1/18	GW	1,059,113
Dearborn	261630033	2842 Wyoming	42.306666	-83.14889	1:12	High Vol for precision	max conc	81102	9	nghbrhd	Wayne	6/12/90	DWL	4,313,002
Dearborn	261630033 continuous	2842 Wyoming	42.306666	-83.14889	continuous	R&P PM10 TEOM	max conc	81102	3	nghbrhd	Wayne	4/1/00	DWL	4,313,002

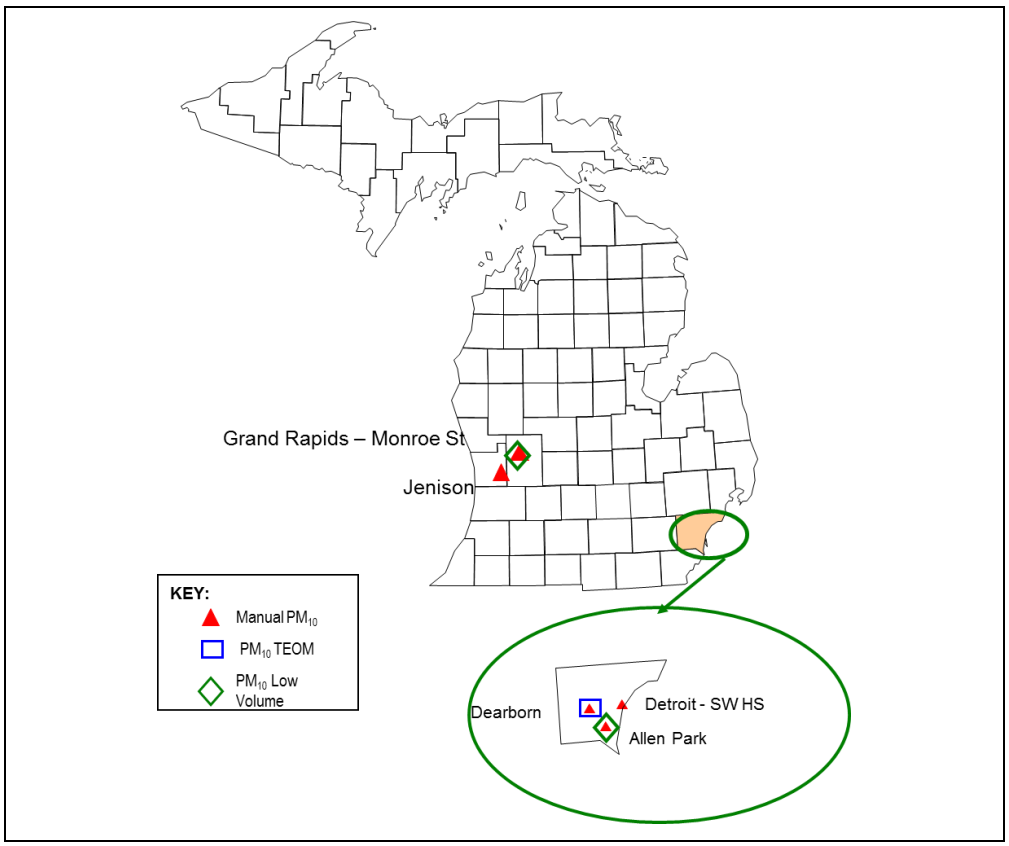
NCore Low Volume PM Coarse Sites

Method: Low volume Partisol 2025 Sampler with down tube and PM_{10} head co-loctaed with low volume Partisol 2025 $PM_{2.5}$ Sampler. PM_{coarse} determined by difference. Method Code 127 (PM_{10}) and Method Code 118 ($PM_{2.5}$)

Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Sampling Frequency	Monitor Type	Purpose	Parameter Code	POC	Scale	County	Start Date	MSA [1]	Pop (2015 Estimate)
Grand Rapids - Monroe St	260810020	1179 Monroe NW	42.984167	-85.67139	1:6	Low Vol Partisol	pop exp	81102	1	nghbrhd	Kent	7/16/11	GW	1,059,113
Allen Park	261630001	14700 Goddard	42.228611	-83.20833	1:6	Low Vol Partisol	pop exp	81102	1	nghbrhd	Wayne	7/16/11	DWL	4,313,002

[1] **MSA Key:** DWL= Detroit-Warren-Livonia MSA
GW = Grand Rapids-Wyoming MSA

Figure 10: Michigan's PM_{10} Monitoring Network



PM_{10} Quality Assurance

The AMU site operator conducts a flow check once a month. Flow check values are sent to the QA Coordinator each quarter and reported to the USEPA's AQS database each quarter. An independent audit is conducted by a member of the AMU's QA Team every six months. The auditor is in a separate line of reporting authority from the site operator and uses independent dedicated equipment to perform the flow rate audit. The auditor also assesses the condition of the monitor and siting criteria. The QA Coordinator reviews all audit results, and hard copies are retained in the QA files. Audit results are uploaded to the USEPA's AQS database each quarter.

Plans for the 2019 PM_{10} Monitoring Network

During 2019, contingent upon adequate levels of funding, the MDEQ is planning to operate high volume PM_{10} monitors sampling over 24 hours at:

- Monroe Street in Grand Rapids (260810020) on a once every six day schedule;
- The PM_{10} monitor in Jenison (261390005) on a once every six day schedule;
- The PM_{10} monitor in Allen Park (261630001) on a once every six day schedule;
- The PM_{10} monitor in Detroit–SWHS (261630015) on a once every six day schedule;
- The PM_{10} monitor in Dearborn (261630033) on a once every six day schedule; and
- The PM_{10} co-located monitor in Dearborn (261630033) on a once every twelve day schedule.

The MDEQ is planning to operate low volume PM_{10} monitors co-located with low volume $PM_{2.5}$ monitors to calculate $PM_{10-2.5}$ at the following NCore sites:

- The low volume PM_{10} monitor at Monroe St. in Grand Rapids (260810020) on a once every six day schedule; and
- The low volume PM_{10} monitor at Allen Park (261630001) on a once every six day schedule.

The MDEQ also planning to operate:

- PM_{10} TEOM at Dearborn (261630033) on an hourly schedule.

CARBON MONOXIDE MONITORING NETWORK

Prior to the latest CO NAAQS review, the MDEQ operated trace CO monitors at Grand Rapids–Monroe St. (260810020) and Allen Park (261630001) as part of NCore.

On August 31, 2011,[9] the USEPA finalized the new CO NAAQS and retained the level and form of the CO NAAQS but revised the design of the ambient monitoring network for CO to be more focused on heavily traveled urban roads. In the rule, CBSAs with population totals equal to or greater than one million people would be required to add CO monitors to near-road monitoring stations that are required in the NO_2 network design. The MDEQ has operated CO monitors at Eliza Howell Near-road (261630093), Eliza-Downwind (261630094) and Livonia Near-road (261630095) sites. The Eliza-Downwind site is no longer required for the study and will be shut down in 2019.

Table 20 summarizes the CO monitoring site information for sites that were in existence in 2018. **Figure 11** shows the distribution of CO monitors across the state of Michigan.

CO Quality Assurance

The AMU site operator performs a precision check of the analyzer every two weeks. Results of precision checks are sent to the QA Coordinator each quarter. Each monitor is audited annually by the AMU's QA Team. The auditor has a separate reporting line of authority from the site operator. The auditor utilizes dedicated gas calibrator and calibration gases that are only for audits. The independent audit challenges the accuracy of the station monitor. The auditor also assesses the monitoring system (inspecting the sample line, filters, and inlet probe), siting, and documentation of precision checks. Results of the audits and precision checks indicate whether the monitor is meeting the measurement quality objectives. The AMU uploads the results of the precision checks and audits to the USEPA's AQS database each quarter. The QA Coordinator reviews all audit results, and hard copies are retained in the QA files.

External audits are conducted by the USEPA's thru-the-probe audit procedure for regular and trace level CO monitors. The USEPA reports the results to AQS.

Plans for the 2019 CO Monitoring Network

During 2019, contingent upon adequate levels of funding, the MDEQ plans to continue to operate trace level CO monitors to support NCore operations:

- Grand Rapids-Monroe St. (26810020); and
- Allen Park (261630001).

During 2019, the MDEQ plans to continue to operate CO monitors to support the near-road network at:

- Eliza Howell (roadway) (261630093); and
- Livonia Near-road (261630095).

[9] USEPA, "National Ambient Air Quality Standards for Carbon Monoxide," 40 CFR parts 50, 53 and 58, proposed rule, January 28, 2011.

During 2019, the MDEQ plans to shut down one near-road site:

- Eliza Howell (downwind) (261630094).

During 2018, two new CO monitors will be installed at two of the new Gordie Howe International Bridge sites:

- DP4TH (261630098); and
- Trinity (261630099).

Table 20: Michigan's CO Monitoring Network

Operating Schedule: Continuous
Method: Gas Filter Correlation Analyzer- CO: Method 054 and Trace CO: Method Code 093

Ncore Sites (Trace)

Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Measurement	Purpose/ Type	Parameter Code	POC	Scale	County	Start Date	MSA [1]	Pop (2015 Estimate)
Grand Rapids - Monroe St	260810020	1179 Monroe NW	42.98417	-85.671389	trace	pop exp	42101	1	nghbrhd	Kent	1/1/08	GW	1,059,113
Allen Park	261630001	14700 Goddard	42.22861	-83.208333	trace	pop exp	42101	1	nghbrhd	Wayne	1/1/08	DWL	4,313,002

Near Roadway Sites

Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Measurement	Purpose	Parameter Code	POC	Scale	County	Start Date	MSA [1]	Pop (2015 Estimate)
Eliza Howell #1	261630093	Service Road I-96 & Telegraph	42.38599	-83.26632	CO	Near Road	42101	1	micro	Wayne	9/1/11	DWL	4,313,002
Livonia Near Road	261630095	18790 Haggerty Road	42.42149	-83.425168	CO	Near Road	42101	1	micro	Wayne	1/1/15	DWL	4,313,002

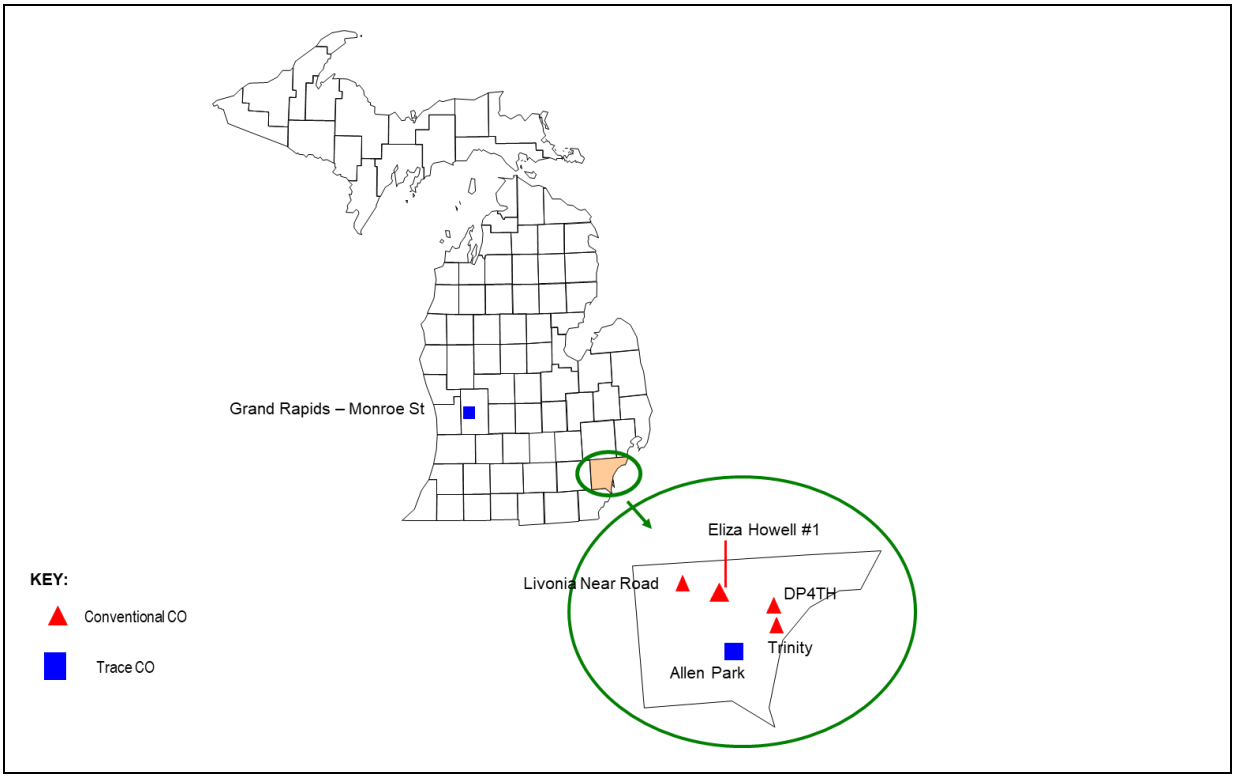
Gordie Howe Bridge Study (GHBS)

Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Measurement	Purpose	Parameter Code	POC	Scale	County	Start Date	MSA [1]	Pop (2015 Estimate)
DP4TH	261630098	4700 W.Fort St.	42.31216	-83.091943	CO	pop exp	42101	1	nghbrhd	Wayne	TBD	DWL	4,313,002
Trinity	261630099	9191 W Fort St.	42.29582	-83.129431	CO	pop exp	42101	1	nghbrhd	Wayne	TBD	DWL	4,313,002

[1] MSA Key:

DWL = Detroit-Warren-Livonia MSA GW = Grand Rapids-Wyoming MSA

Figure 11: Michigan's CO Monitoring Network



NITROGEN DIOXIDE and NO_Y MONITORING NETWORK

On February 9, 2010, the USEPA modified the NO_2 NAAQS. Prior to this date, there was a single form of the standard; the annual average concentration of NO_2 could not be greater than 53 ppb. The USEPA has added an hourly level of 100 ppb to the NAAQS.

Along with modifications to the standard, changes to the design of the ambient monitoring network also occurred. A three-tiered monitoring network for NO_2 will focus on near-road monitoring as well as monitoring at ambient locations. The minimally required components of the network are:

Tier 1: Near-road Monitors

A. Every CBSA with a population greater than or equal to 500,000 people must have a microscale NO_2 monitor located within 50 meters of a major roadway.

B. An additional near-roadway site is required in CBSAs with populations of 2,500,000 or more.

C. An additional near-roadway site is required for any roadway segment with 250,000 or more annual average daily traffic (AADT) totals.

Tier 2: Area-wide Monitors

A. One NO_2 monitor in every CBSA with a population equal to or greater than 1,000,000 people. This monitor should be located in an area with an expected high concentration of NO_2 and should use a neighborhood or larger scale. Emission inventory data should be used to make this selection.

Tier 3: Regional Administrator Required Monitors

A. The USEPA Administrator must require a minimum of 40 NO_2 monitors nationwide in locations with "susceptible and vulnerable" populations.

The network design described above shall use the latest available US Census figures. The new monitoring stations must be deployed and operational by January 1, 2013[10]. Because of budgetary constraints, the USEPA has developed a build-and-hold system for implementing the new monitoring locations. Two Detroit near-road monitoring sites have been deployed. In addition, the MDEQ operates the community scale NO_2 monitor at its Detroit-E 7 Mile (261630019) site. The USEPA has finalized a new rule, which eliminates the third phase of the near road sites. This would have removed the requirement for a near-road site in Grand Rapids; however, the Grand Rapids CBSA is now over the population threshold for a Tier One near-road site. The MDEQ is working with Region 5 USEPA and OAQPS USEPA to secure funding to deploy a near-road site in Grand Rapids. The MDEQ cannot deploy a near-road site in Grand Rapids until it is fully funded by the USEPA. Eliza Howell (downwind) (261630094) will be shut down completely at the end 2018 to ease the workload. Historically, this site has been for research and is not federally required.

[10] "Primary National Ambient Air Quality Standards for Nitrogen Dioxide," USEPA, 40 CFR Parts 50 and 58. February 9, 2010.

Table 21 summarizes the monitoring requirements for NO_2 according to the various tiers for all CBSAs in Michigan. As shown by this table, one monitor is required in Grand Rapids-Wyoming MSA and three monitors are required in the Detroit-Warren-Livonia MSA.

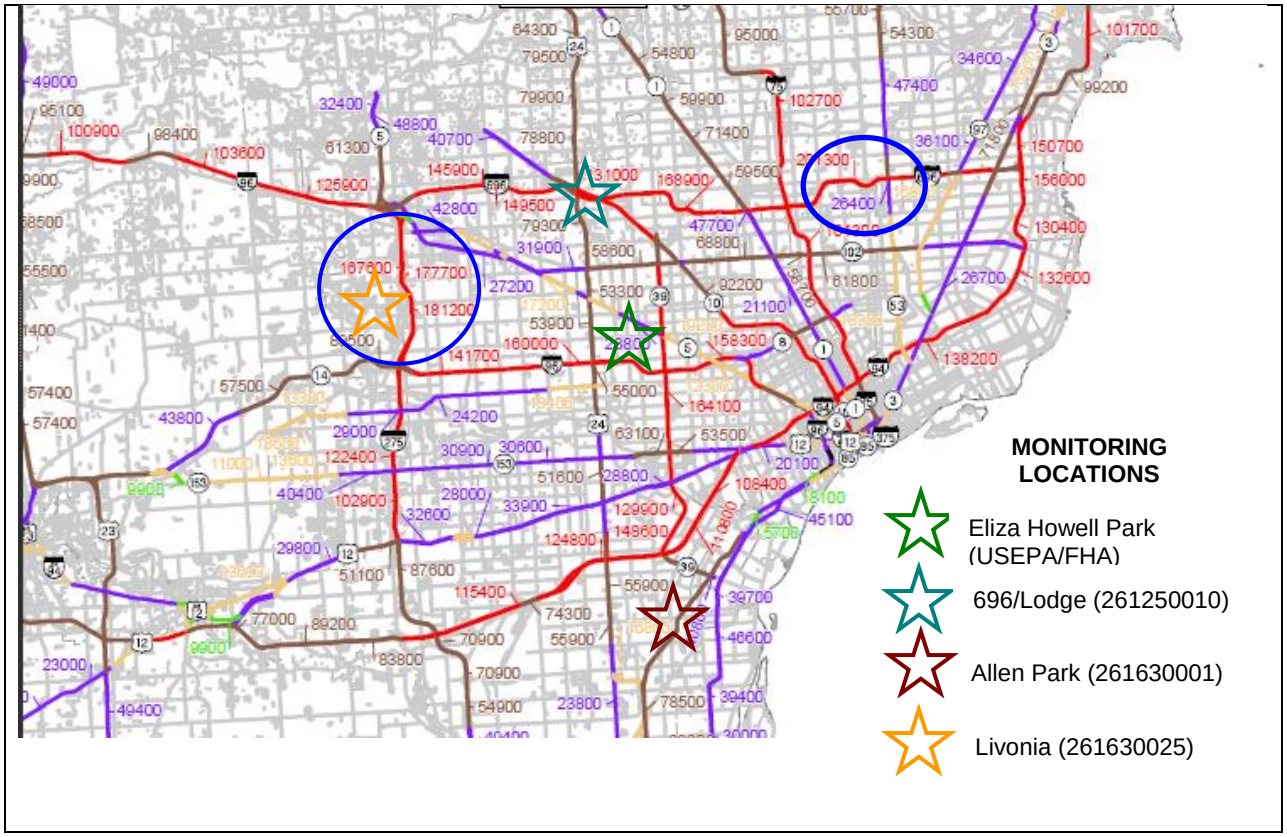
Table 21: NO_2 Network Design

MSA	Counties	2017 Estimated Population	Near Roadway Monitors Req'd	Additional Near Roadway Site	250,000 AADT	Community Wide Monitor	EJ Monitor
Detroit-Warren-Livonia MSA	Macomb Oakland Wayne Lapeer St Clair Livingston	4,313,002	1	1		1	
Flint MSA	Genesee	407,385					
Monroe MSA	Monroe	149,649					
Ann Arbor MSA	Washtenaw	367,627					
Grand Rapids-Wyoming MSA	Kent Barry Ottawa Montcalm	1,059,113	1			1	
Muskegon-Norton Shores MSA	Muskegon	173,693					
Lansing-East Lansing MSA	Clinton Ingham Eaton	477,656					
Bay City MSA	Bay	104,239					
Saginaw MSA	Saginaw	191,934					
Kalamazoo-Portage MSA	Kalamazoo Van Buren	338,338					
Niles-Benton Harbor MSA	Berrien	154,259					
Jackson MSA	Jackson	158,640					
Battle Creek MSA	Calhoun	134,128					
South Bend Mishawaka MSA IN/MI	Cass St. Joseph, IN	321,815					

Tier 1: Near-road NO_2 Monitors – Phase 2

The second near-roadway site for the Detroit-Warren-Livonia MSA was due by January 1, 2015. The Livonia Near-road site (261630095) was established in December 2014 and was operational by January 1, 2015. This is the heaviest traveled traffic segment in the Detroit-Warren-Livonia MSA; see yellow star on **Figure 12**.

Figure 12: Comparison of Eliza Howell Park Location with Other Air Monitoring Stations and Roadway Segments with High Traffic Counts

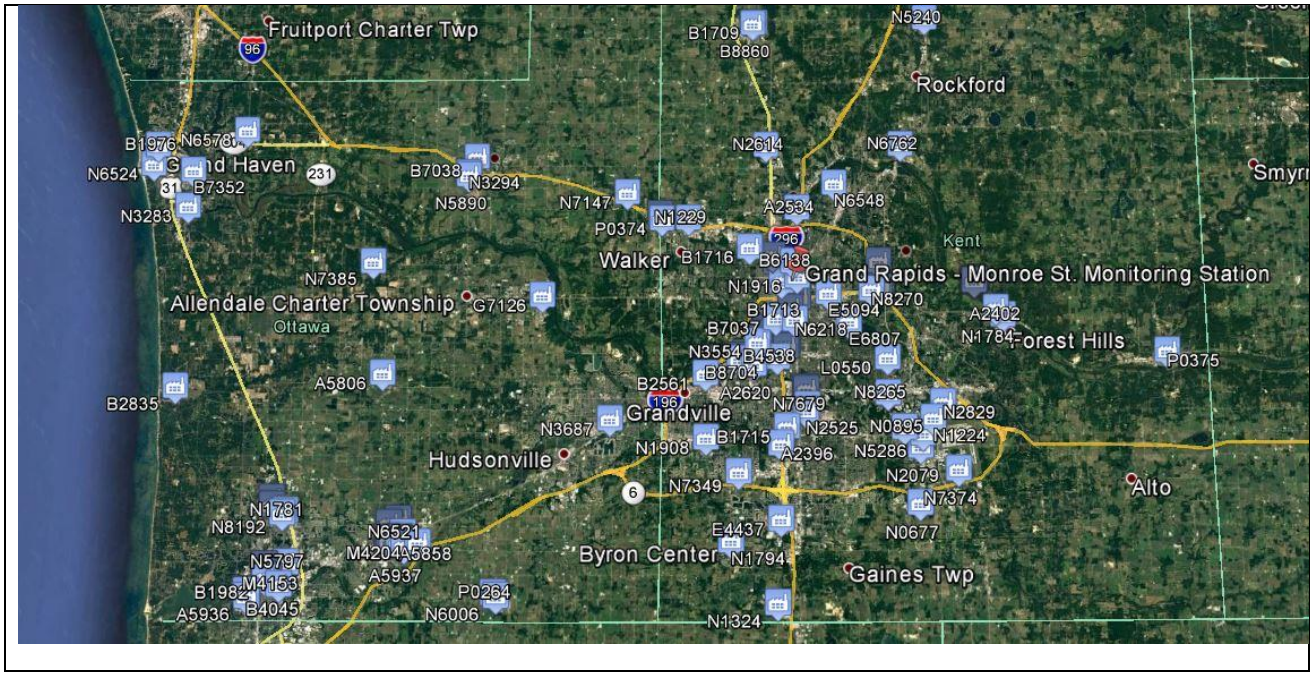


Tier 2: Area-wide NO_2 Monitors

Area-wide monitoring is required in every CBSA with 1,000,000 or more people. The Detroit-Warren-Livonia MSA and the Grand Rapids-Wyoming MSA both meet this requirement in Michigan. The MDEQ is currently operating an NO_2 monitor at the Detroit-E 7 Mile site (261630019) in northeast Detroit, which is downwind from the urban core and located in a residential neighborhood expected to have high NO_2 levels. A new NO_2 monitor must be added into the Grand Rapids-Wyoming MSA to meet this requirement.

After investigation the sources of NO_2 emissions, the MDEQ feels it is appropriate to place a monitor at the Grand Rapids-Monroe St. (260810020). **Figure 13** shows the NO_2 emission points for Kent and Ottawa Counties, as well as the location of the Grand Rapids-Monroe Street site. This site has been designated as a PAMS site by the USEPA. It is MDEQ's intention to run the direct NO_2 instrument required by the PAMS program year round to meet the Area-wide NO_2 requirement. The direct NO_2 instrument has not been received due to delay in the PAM's national contracts. In the meanwhile, the MDEQ will temporarily install a traditional NO_x instrument at Jenison (261390005) in lieu of the NO_2 monitor.

Figure 13: NO_2 Emissions in Kent and Ottawa Counties



Tier 3: NO_2 Monitors for Susceptible and Vulnerable Populations

The final tier of the new NO_2 monitoring network could include an environmental justice component as determined by the USEPA Administrator. Forty additional monitoring sites will be deployed throughout the nation to meet the environmental justice component of the network design. At this time, the MDEQ is not planning on deploying any of these monitors. However, as part of a special study, the MDEQ is installing NO_x monitors at three new sites in 2018 to study the impacts of the Gordie Howe International Bridge project.

NO_2 Monitoring for NSR

Recent modeling projects for new source review have shown that there is a possibility that the new 1-hour NO_2 NAAQS could be violated using current modeling techniques. More refined modeling that would provide a more accurate picture of the impact from new sources could be performed; however, the MDEQ lacked ambient data required for use in the models. At least five years of NO_2 data are required in both urban and rural locations. Therefore, on July 1, 2010, the MDEQ began collecting NO_2 measurements at Houghton Lake (261130001) and at Lansing (260650012). The MDEQ will continue this monitoring at the new Lansing Filley (260650018) site.

NO_Y Monitoring

Trace NO_Y monitors for the NCore sites at Grand Rapids–Monroe St. (260810020) and Allen Park (261630001) have been operational since December 2007.

Table 22 summarizes the NO_2 and NO_Y monitoring site information for sites that are in existence in 2018 and 2019. **Figure 14** shows the NO_2 and NO_Y monitoring network operated by the MDEQ in 2018 and 2019.

NO_2 and NO_Y Quality Assurance

The AMU site operator performs a precision check of the analyzer every two weeks. The precision checks are sent to the QA Coordinator each month. Each monitor is audited annually by the AMU's QA Team, which has a separate reporting line of authority from the site operator. The auditor utilizes dedicated gas calibrator and calibration gases that are only for audits. The independent audit challenges the accuracy of the station monitor. The auditor also assesses the monitoring system (inspecting the sample line, filters, and inlet probe), siting, and documentation of precision checks. The results of the audits and precision checks indicate whether the monitor is meeting the measurement quality objectives. The AMU uploads the precision check results and audit results to the USEPA's AQS database each quarter. The QA Coordinator reviews all audit results, and hard copies are retained in the QA files.

For conventional (non-trace level) NO_2 monitors, the USEPA conducts thru-the-probe audits at 20% of the monitors each year. The audit consists of delivering four levels of calibration gas to the station monitor through the probe. At this time, the USEPA is not conducting thru-the-probe audits for the NO_Y monitors.

Plans for the 2019 NO_2 and NO_Y Monitoring Network

During 2019, contingent upon adequate levels of funding, the MDEQ is planning to operate NO_2 at:

- Lansing Filley (260650018);
- Houghton Lake (261130001);
- Detroit-E 7 Mile (261630019);
- Eliza Howell Near-road site (261630093);
- Livonia Near-road (261630095); and
- SWHS (261630015).

During 2019, the MDEQ is planning to operate NO_2 at three new sites to study the impacts of the Gordie Howe International Bridge construction:

- DP4TH (261630098);
- Trinity (261630099); and
- TBD (261630100).

By January 1, 2019, the MDEQ is planning to shut down the Eliza Howell downwind (261630094) monitor.

The MDEQ will temporarily install a NO_x monitor in Jenison (261390005) to meet the Grand Rapids area requirement until the PAMs funding is received for direct NO_2 at Grand Rapids-Monroe St. (260810020). Also contingent upon adequate funding, the MDEQ will continue to operate trace level NO_Y monitors at the NCore sites:

- Grand Rapids–Monroe St. (26810020); and
- Allen Park (261630001).

Table 22: Michigan's NO_2 and NO_Y Monitoring Network

Operating Schedule: Continuous
Method: Chemiluminescense, Method Code 074 (NOx) and Method Code 075 (NO_y)

NCore Sites

Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Measurement	Purpose/ Type	Parameter Code	POC	Scale	County	Start Date	CBSA [1]	Pop (2015 Estimate)
Grand Rapids - Monroe St	260810020	1179 Monroe NW	42.984167	-85.671389	NOy	pop exp	42612	1	nghbrhd	Kent	1/1/08	GW	1,059,113
Allen Park	261630001	14700 Goddard	42.228611	-83.208333	NOy	pop exp	42612	1	nghbrhd	Wayne	1/1/08	DWL	4,313,002

Tier 1: Near Roadway Sites

Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Measurement	Purpose/ Type	Parameter Code	POC	Scale	County	Start Date	CBSA [1]	Pop (2015 Estimate)
Eliza Howell #1	261630093	Service Road I-96 & Telegraph	42.38599	-83.26632	NO2	Near Road	42602	1	micro	Wayne	9/1/11	DWL	4,313,002
Livonia Near Road	261630095	18790 Haggerty Raod	42.421494	-83.425168	NO2	Near Road	42602	1	micro	Wayne	1/1/15	DWL	4,313,002

Tier 2: Community Sites

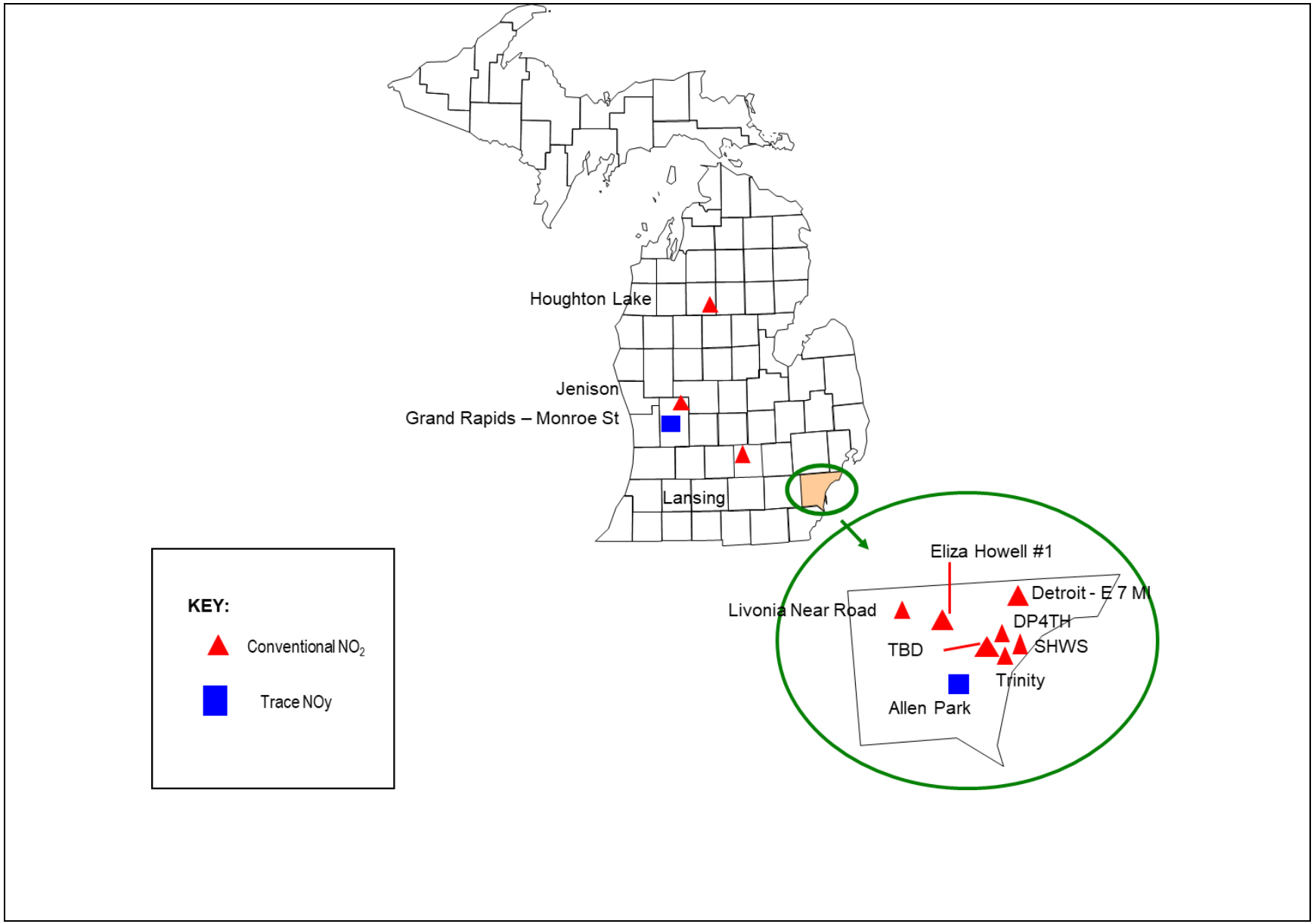
Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Measurement	Purpose/ Type	Parameter Code	POC	Scale	County	Start Date	CBSA [1]	Pop (2015 Estimate)
Detroit - E 7 Mile	261630019	11600 East Seven Mile Road	42.430833	-83.000278	NO2	pop exp	42602	1	urban	Wayne	12/1/90	DWL	4,313,002
Lansing	260650012	220 N Pennsylvania	42.738611	-84.534722	NO2	pop exp	42602	1	nghbrhd	Ingham	9/5/80	LEL	477,656
Houghton Lake	261130001	1769 S Jeffs Road	44.310556	-84.891944	NO2	background	42602	1	regional	Missaukee	4/1/98	Not in CBSA	N/A
Jenison	261390005	6981 28th Ave,Georgetown Township	42.8944	-85.85278	NO2	pop exp	42602	1	urban	Ottawa	1/1/19	GW	1,059,113
SWHS	261630015	150 Waterman	42.302778	-83.106667	NO2	pop exp	42602	1	urban	Wayne	TBD	DWL	4,313,002

Gorgie Howe Bridge Study(GHBS)

Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Measurement	Purpose/ Type	Parameter Code	POC	Scale	County	Start Date	CBSA [1]	Pop (2015 Estimate)
DP4	261630098	4700 W. Fort St	42.312158	-83.091943	NO2	pop exp	42602	1	nghbrhd	Wayne	TBD	DWL	4,313,002
Trinity	261630099	9191 W. Fort St.	42.295824	-83.129431	NO2	pop exp	42602	1	nghbrhd	Wayne	TBD	DWL	4,313,002
TBD	261630100				NO2	pop exp	42602	1	nghbrhd	Wayne	TBD	DWL	4,313,002

[1] **CBSA Key:**
DWL= Detroit-Warren-Livonia Metro. Area
GW=Grand Rapids-Wyoming Metro. Area
LEL= Lansing-East Lansing MSA

Figure 14: Michigan's NO_2 and NO_Y Monitoring Network



SULFUR DIOXIDE MONITORING NETWORK

On June 2, 2010, the USEPA made the SO_2 NAAQS more stringent by changing the current standard from a 24-hour and an annual average to an hourly measurement that cannot exceed 75 ppb. The form of the standard is now a 99th percentile form averaged over three years. The secondary standard has not been changed[11].

To design a monitoring network, the USEPA created the Population Weighted Emissions Index (PWEI) that is calculated by:

(CBSA population[12]) * (total SO_2 emissions in that CBSA in tpy) / 1,0000,000 = PWEI

The PWEI value for each CBSA is compared to the threshold values shown in **Table 23** to determine the number of monitoring sites that are required:

Table 23: Population Weighted Emission Index-based Monitoring Requirements

Population Weighted Emissions Index Value	Number of Sites
Greater than or equal to 1,000,000	3
Greater 100,000 but less than 1,000,000	2
Greater than 5,000	1

The PWEI monitors serve a variety of purposes including assessing population exposure, determining trends and transport as well as ascertaining background levels.

The USEPA allows agencies to count the NCore SO_2 monitors as part of these new requirements. Also, because the new SO_2 monitors are not single source-oriented, existing infrastructure can be used to select locations for expansion of the SO_2 network.

In 2018, MDEQ is installing three SO_2 monitors at three new sites to study the impacts of the Gordie Howe International Bridge construction.

If **Table 23** is applied to the PWEI calculations for the CBSAs in Michigan, the number of monitors that are required is shown in **Table 24**. The data in the table uses the 2010 US Census data and the 2008 version of the National Emissions Inventory data.

[11] Primary National Ambient Air Quality Standards for Sulfur Dioxide; Final Rule, 75 *Federal Register* 35520 (June 22, 2010).
[12] According to the latest US Census Bureau estimates.

Table 24: Population Weighted Emissions Index Totals for CBSAs in Michigan

MSA	Counties	2008 NEI Download: Total County SO_2 Emissions, tpy	2008 NEI SO_2 Total Emissions, tpy	2010 Population	2008/2010 NEI PWEI	Monitors Required 2008 EI & 2010 Census
Detroit-Warren-Livonia Metro Area	Macomb	1,367.46	124,738	4,296,250	535,905	2
	Oakland	2,780.69				
	Wayne	55,790.51				
	Lapeer	152.87				
	St Clair	64,388.92				
	Livingston	257.45				
Flint Metro Area	Genesee	538.38	538	425,790	229	0
Monroe Metro Area	Monroe	135,799.72	135,800	152,021	20,644	1
Ann Arbor Metro Area	Washtenaw	530.36	530	344,791	183	0
Grand Rapids-Wyoming Metro Area	Kent	1,539.62	1,843	774,160	1,427	0
	Barry	116.40				
	Newaygo	75.23				
	Ionia	111.60				
Holland-Grand Haven Metro Area	Ottawa	39,664.67	39,665	263,801	10,464	1
Muskegon-Norton Shores Metro Area	Muskegon	11,611.80	11,612	172,188	1,999	0
Lansing-East Lansing Metro Area	Clinton	141.76	14,184	464,036	6,582	1
	Ingham	10,546.34				
	Eaton	3,496.12				
Bay City Metro Area	Bay	19,073.08	19,073	107,771	2,056	0
Saginaw-Saginaw Twp N Metro Area	Saginaw	821.42	821	200,169	164	0
Kalamazoo-Portage Metro Area	Kalamazoo	1,672.04	1,810	326,589	591	0
	Van Buren	138.04				
Niles-Benton Harbor Metro Area	Berrien	384.68	385	156,813	60	0
Jackson Metro Area	Jackson	293.11	293	160,248	47	0
Battle Creek Metro Area	Calhoun	666.26	666	136,146	91	0
South Bend Mishawaka Metro Area IN/MI	Cass	98.09	98	52,293	5	0

Based on the 2008 emissions data and 2010 population estimates, the Detroit-Warren-Livonia CBSA needs two SO_2 monitoring sites, while the Holland-Grand Haven Metropolitan Area, Lansing-East Lansing Metropolitan Area, and Monroe Metropolitan Area each need a single SO_2 monitoring site.

The NCore trace level SO_2 monitor at Allen Park (261630001) fulfills the requirement for one of the SO_2 monitors required in the Detroit-Warren-Livonia CBSA. The MDEQ also monitors at Detroit–SWHS (261630015) and Port Huron (261470005).

The MDEQ deployed the Sterling State Park (261150006) site on January 1, 2013, to fulfill the requirement for the Monroe Metropolitan Area.

The MDEQ deployed SO_2 monitors in the Holland-Grand Haven Metropolitan Area at the West Olive site (261390011) in Ottawa County on January 1, 2015 and in the Lansing-East Lansing Metropolitan Area at the Lansing site (260650012) in Ingham County, on January 1, 2012. Due to loss of site access, the Lansing site (260650012) was moved to a new location in May 2018 Lansing Filley (261630018).

Table 25 summarizes the SO_2 monitoring site information for 2018 and 2019. **Figure 16** shows the geographical distribution of SO_2 sites across Michigan.

SO_2 Monitoring and Modeling Requirements

With the revision to the SO_2 NAAQS in 2010 federal regulations also changed for both monitoring and modeling SO_2 emissions. The USEPA established a three-tiered process for assessing the attainment status of the ambient air near large sources emitting SO_2. States were first required to establish monitoring stations in areas with high population levels and high emission levels. Existing monitors in Detroit and Lansing, and new monitors in West Olive and Monroe, met this obligation for assessment. Of these four areas, only a small region in eastern Wayne County was found to have levels of SO_2 exceeding the health-based standard. This area was designated by the USEPA as nonattainment. The MDEQ has completed an attainment plan that will bring the area into compliance with the NAAQS.

The second tier requires states to conduct either monitoring or modeling for sources emitting over 16,000 tons per year. The MDEQ identified six areas meeting this criterion. Modeling has been completed for sources in the St. Clair, Eaton, Ingham, Marquette, Ottawa, Bay and Monroe Counties. The USEPA reviewed the modeling designated a small portion of St. Clair County as nonattainment in September 2016. The other areas were designated attainment/unclassifiable in September 2016. Control strategies will be developed for the sources in St. Clair County and the attainment plan will be incorporated into the Michigan State Implementation Plan (SIP). DTE Energy has installed two SO_2 special purpose monitoring stations in St. Clair County to provide additional SO_2 and meteorological data to aid future SIP development. These monitors are not part of a Data Requirements Rule network.

The third tier involves modeling of SO_2 source emissions greater than 2000 tons per year. This modeling project involved Delta and Alpena Counties and was submitted to the USEPA on January 11, 2017. There were no nonattainment areas recommended from this modeling.

The necessity of taking a combination monitoring/modeling approach to assessment for SO_2 was borne from the fact that monitoring could not cover every wind scenario at each large emission source nationwide and states could not bear the large associated expenses of establishing enough new monitoring sites to adequately characterize the SO_2 pollutant levels in ambient air. Assessment is enhanced with additional modeling, a less expensive methodology that helps inform planners about the degree of a problem needing to be solved and the effectiveness of different proposed control options.

The MDEQ continues to identify strategies to reduce SO_2 pollutant levels through collaboration with Michigan industry, as well as local and federal partners.

SO_2 Quality Assurance

The AMU site operator performs a precision check of the analyzer every two weeks. Precision checks are sent to the QA Coordinator each quarter. Each monitor is audited annually by the AMU's QA Team, which has a separate reporting line of authority from the site operator. The auditor utilizes dedicated gas calibrator and calibration gases that are only for audits. The independent audit challenges the accuracy of the station monitor. The auditor also assesses the monitoring system (inspecting the sample line, filters, and inlet probe), siting, and documentation of precision checks. Results of the audits and precision checks indicate whether the monitor is meeting the measurement quality objectives. The AMU uploads the precision check results and audit results to the USEPA's AQS database each quarter. The QA Coordinator reviews all audit results, and hard copies are retained in the QA files.

The USEPA conducts thru-the-probe audits on 20% of the SO_2 monitors each year. The audit consists of delivering four levels of calibration gas to the station monitor through the probe. The USEPA reports the audit results to AQS.

Plans for the 2019 SO_2 Monitoring Network

During 2019, contingent upon adequate levels of funding, the MDEQ is planning to continue to operate an SO_2 monitor at:

- Detroit-SWHS (261630015);
- Grand Rapids–Monroe St. (260810020);
- Allen Park (261630001);
- Lansing (260650018);
- Port Huron (261470005);
- Sterling State Park (261150006);
- West Olive (261390011); and
- NMH 48217 (261630097).

The MDEQ is planning to operate three SO_2 monitors for the Gordie Howe International Bridge project in southwest Detroit at:

- DP4TH (261630098);
- Trinity (261630099); and
- TBD (2161630100).

Table 25: Michigan's SO_2 Monitoring Network

Operating Schedule: Continuous
Method: Ultra Violet Stimulated Fluorescence; Method Code 060 (SO_2) and Method Code 600 (Trace SO_2)

NCore Sites, Trace

Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Measurement	Purpose/ Type	Parmeter Code	POC	Scale	County	Start Date	MSA [1]	Pop (2015 Estimated)
Grand Rapids - Monroe St.	260810020	1179 Monroe NW	42.9842	-85.671389	trace	pop exp	42401	2	nghbrhd	Kent	1/1/08	GW	1,059,113
Allen Park	261630001	14700 Goddard	42.2286	-83.208333	trace	pop exp	42401	1	nghbrhd	Wayne	1/1/08	DWL	4,313,002

Source-Oriented Sites

Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Measurement	Purpose/ Type	Parmeter Code	POC	Scale	County	Start Date	MSA [1]	Pop (2015 Estimated)
Lansing	260650012	220 N Pennsylvania	42.7386	-84.534722	SO2	Max Conc	42401	1	nghbrhd	Ingham	1/1/12	LEL	477,656
Sterling Sate Park	261150006	2800 State Park Road	41.9236	-83.345858	SO2	Max Conc	42401	1	nghbrhd	Monroe	1/1/13	Monroe	149,649
West Olive	261390011	8578 Hiawatha Dr.	42.9231	-86.194604	SO2	Max Conc	42401	1	nghbrhd	Ottawa	1/1/15	GW	1,059,113
Detroit - SW HS	261630015	150 Waterman	42.3028	-83.106667	SO2	Max Conc	42401	1	nghbrhd	Wayne	1/1/71	DWL	4,313,002
Port Huron	261470005	2525 Dove Rd	42.9533	-82.456389	SO2	Max Conc	42401	1	urban	Saint Clair	2/28/81*	DWL	4,313,002

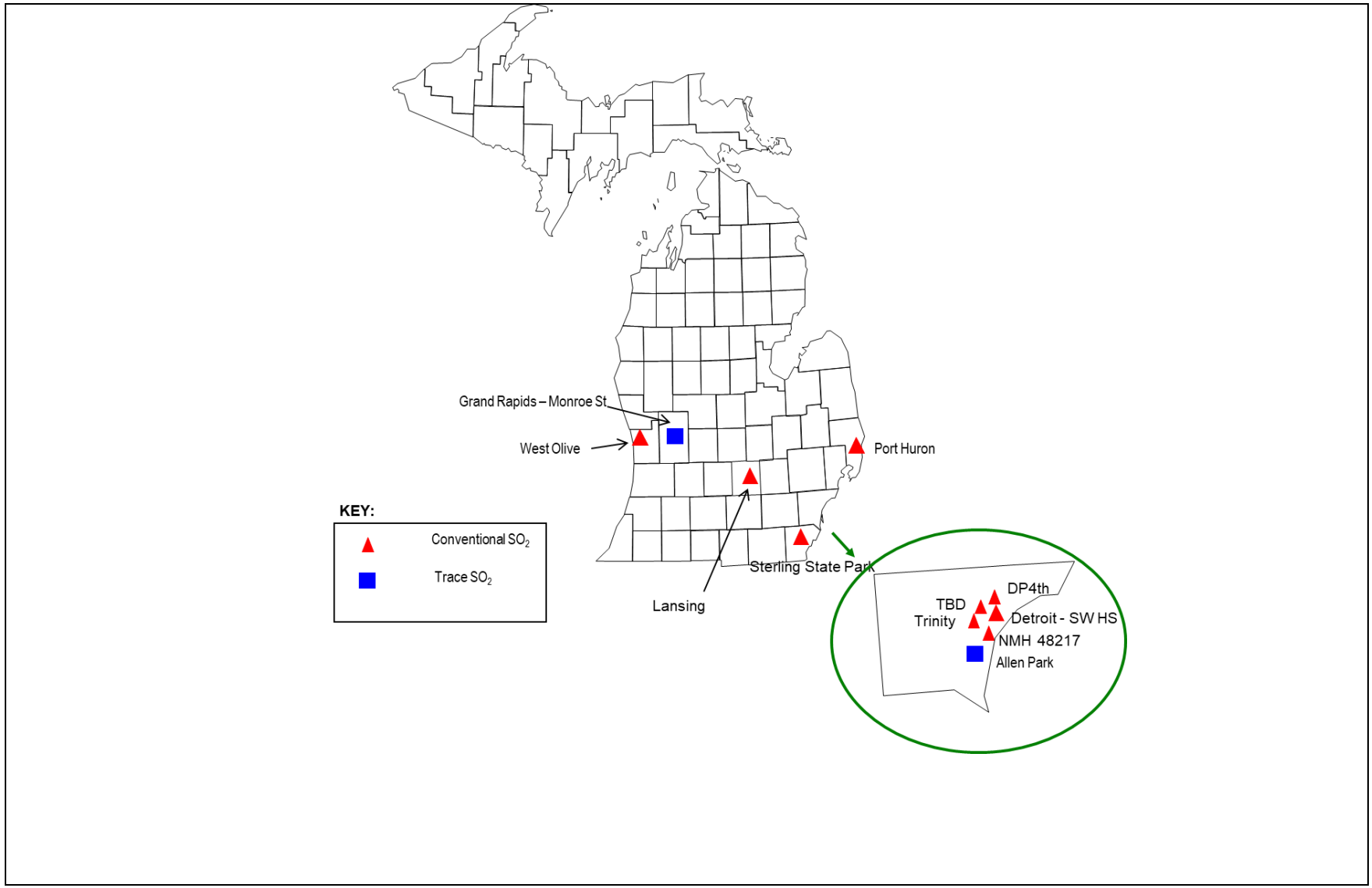
Population-oriented Sites

Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Measurement	Purpose/ Type	Parmeter Code	POC	Scale	County	Start Date	MSA [1]	Pop (2015 Estimated)
NMH 48217	261630097	3225 S. Deacon St.	42.2617	-83.157893	SO2	pop exp	42401	1	nghbrhd	Wayne	8/24/16	DWL	4,313,002
DR4	261630098	4700 W. Fort St	42.31216	-83.091943	SO2	pop exp	42401	1	nghbrhd	Wayne	TBD	DWL	4,313,002
Trinity	261630099	9191 W. Fort St.	42.29582	-83.129431	SO2	pop exp	42401	1	nghbrhd	Wayne	TBD	DWL	4,313,002
Clemente	261630100	1551 Beard St	42.3104	-83.115923	SO2	pop exp	42401	1	nghbrhd	Wayne	TBD	DWL	4,313,002

[1] **MSA Key:** DWL = Detroit-Warren-Livonia MSA
GW = Grand Rapids-Wyoming MSA
LEL = Lansing-East Lansing MSA
Monroe = Monroe MSA

* Monitor shutdown in 2007 restarted in January 2012

Figure 15: Michigan's SO_2 Monitoring Network



TRACE METAL MONITORING NETWORK

Since 1981, monitoring for trace metals as TSP has been conducted as part of the Michigan Toxics Air Monitoring Program (MITAMP). Over the years, the program gradually expanded to eight sites that collected TSP samples on a once every six or once every 12 day schedule. The trace metals network follows the sampling calendar published by the USEPA. The samples were analyzed for trace levels of metals. The suite of elements has been modified over the years, with the most recent list including manganese, arsenic, cadmium, and nickel at all sites. As stated in the Lead section the MDEQ is proposing to add TSP lead to all trace metals sites. Lead is monitored at source-oriented sites and at NCore sites, as discussed in the Lead section of this report. The Dearborn NATTS Site (261630033) has a more extensive metals list, which includes: beryllium, vanadium, chromium, manganese, nickel, cobalt, copper, zinc, arsenic, molybdenum, cadmium, barium, lead, and iron.

As part of the Gordie Howe International Bridge project, trace metals will be added to the three sites.

The trace metals sites include:

- Allen Park (261630001)
- Detroit-SWHS (261630015)
- S. Delray-Jefferson (261630027)
- River Rouge (261630005)
- Dearborn (261630033)
- NMH 48217 (261630097)
- DP4TH (261630098)
- Trinity (261630099)
- TBD (261630100)
- Belding-Merrick St. (260670003)
- Port Huron (261470031)

Trace metals as PM_{10} are determined as part of the NATTS program at Dearborn (261630033). To promote comparability with the TSP-size trace metals collected at other monitoring stations, and to assess both inter-sampler precision and method precision, co-located PM_{10} and TSP trace metals are also collected at Dearborn.

Table 26 summarizes the trace metals monitoring site information for 2018 and 2019. **Figure 16** shows the geographical distribution of sites across Michigan.

Table 26: Michigan's Trace Metal Monitoring Network

Operating Schedule: 1:6, follows EPA published calendar

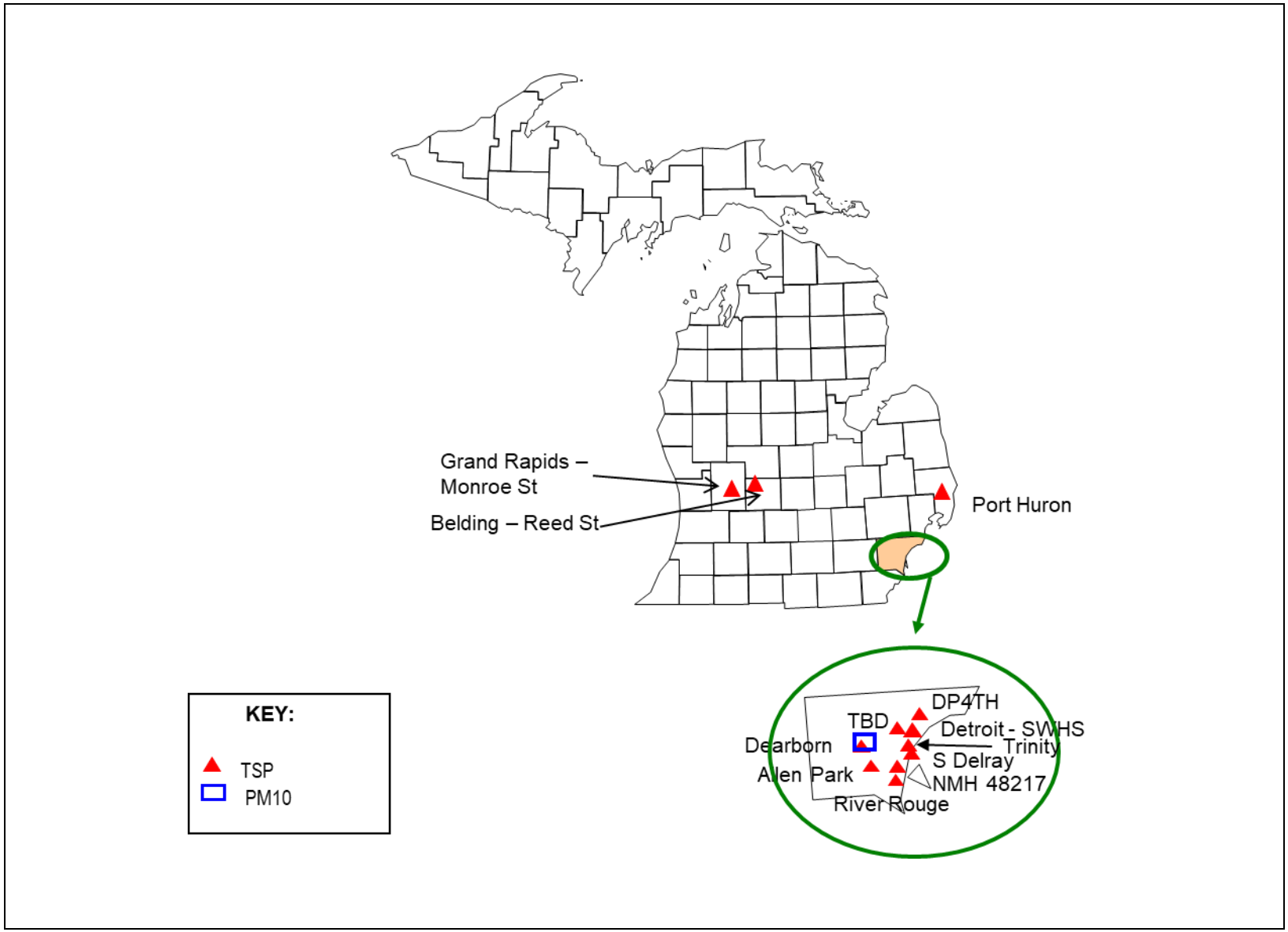
Method: TSP: High Volume sampler using glass fiber filter ; Emission Spectra ICAP for lead; ICP MS for remaining metals

PM10: High Volume sampler using quartz filter; Emission Spectra ICAP for lead; ICP MS for remaining metals

Monitoring Sites														
Site Name	AQS Site ID	Address	Latitude	Longitude	Sampling Frequency	Elements	Size	Purpose/ Type	POC	Scale	County	Date Estab.	MSA [1]	Pop (2015 Estimated)
Belding - Merrick St	260670003	509 Merrick	43.09984	-85.22163	1:6	Pb, Mn, As, Cd, Ni	TSP	max conc	1	micro	Ionia	1/1/10	I	64,223
Grand Rapids - Monroe St	260810020	1179 Monroe St NW	42.984167	-85.671389	1:6	Pb, Mn, As, Cd, Ni	TSP	pop exp	1	nghbrhd	Kent	1/8/10	GW	1,059,113
Port Huron	261470031	324 Rural St	42.98209	-82.449233	1:6	Pb, Mn, As, Cd, Ni	TSP	max conc	1	micro	Saint Clair	1/1/13	DWL	4,313,002
Allen Park	261630001	14700 Goddard	42.228611	-83.208333	1:6	Pb, Mn, As, Cd, Ni	TSP	pop exp	1	nghbrhd	Wayne	5/1/99	DWL	4,313,002
Dearborn	261630033	2842 Wyoming	42.306666	-83.148889	1:6	Be, V, Cr, Mn, Co, Ni, Cu, Zn, As, Mo, Cd, Ba, Pb, Fe	TSP	max conc	1	nghbrhd	Wayne	6/1/90	DWL	4,313,002
River Rouge	261630005	315 Genesee	42.267222	-83.132222	1:6	Pb, Mn, As, Cd, Ni	TSP	max conc	1	nghbrhd	Wayne	1/1/94	DWL	4,313,002
Fort St. (SWHS)	261630015	150 Waterman	42.302778	-83.106667	1:6	Pb, Mn, As, Cd, Ni	TSP	pop exp	1	nghbrhd	Wayne	2/26/99	DWL	4,313,002
S Delray	261630027	7701 W Jefferson	42.292222	-83.106944	1:6	Pb, Mn, As, Cd, Ni	TSP	max conc	1	nghbrhd	Wayne	10/6/04	DWL	4,313,002
Dearborn	261630033	2842 Wyoming	42.306666	-83.148889	1:12	Be, V, Cr, Mn, Co, Ni, Cu, Zn, As, Mo, Cd, Ba, Pb, Fe	TSP	max conc	2	nghbrhd	Wayne	6/1/90	DWL	4,313,002
NMH 48217	261630097)	3225 S. Deacon	42.261669	-83.157893	1:6	Pb, Mn, As, Cd, Ni	TSP	pop exp	1	nghbrhd	Wayne	1/9/16	DWL	4,313,002
DP4TH	261630098	4700 W. Fort St	42.312158	-83.091943	1:6	Pb, Mn, As, Cd, Ni	TSP	pop exp	1	nghbrhd	Wayne	TBD	DWL	4,313,002
Trinity	261630099	9191 W. Fort St.	42.295824	-83.129431	1:6	Pb, Mn, As, Cd, Ni	TSP	pop exp	1	nghbrhd	Wayne	TBD	DWL	4,313,002
TBD	261630100				1:6	Pb, Mn, As, Cd, Ni	TSP	pop exp	1	nghbrhd	Wayne	TBD	DWL	4,313,002
Dearborn	261630033	2842 Wyoming	42.306666	-83.148889	1:6	Be, V, Cr, Mn, Co, Ni, Cu, Zn, As, Mo, Cd, Ba, Pb, Fe	PM 10	max conc	1	nghbrhd	Wayne	6/1/90	DWL	4,313,002
Dearborn	261630033	2842 Wyoming	42.306666	-83.148889	1:12	Be, V, Cr, Mn, Co, Ni, Cu, Zn, As, Mo, Cd, Ba, Pb, Fe	PM 10	max conc	9	nghbrhd	Wayne	6/1/90	DWL	4,313,002

[1] MSA Key: DWL= Detroit-Warren-Livonia MSA GW = Grand Rapids- Wyoming MSA
I = Ionia Micropolitan

FIGURE 16: MICHIGAN'S TRACE METAL MONITORING NETWORK



Trace Metal Quality Assurance

The site operator conducts a precision flow check once a month. Flow check values are sent to the QA Coordinator each quarter. An independent audit is conducted by a member of the AMU's QA Team every six months. The auditor is in a separate line of reporting authority from the site operator and uses independent, dedicated equipment to perform the flow rate audit. The auditor also assesses the condition of the monitor and siting criteria. The QA Coordinator reviews all audit results, and hard copies are retained in the QA files.

The MDEQ Laboratory participates in two types of external performance testing programs. A nationally-based audit program sends a sample that has a known concentration of metals spiked onto a filter. The lab analyzes the filter in the same fashion as the routine samples. Results are compared to a "true" value and tabulated for all participants in the program. The MDEQ Laboratory also receives regional round robin audits. The regional audit sample is collected by running an ambient air monitor for 24 hours. The filter is cut into strips and sent to several laboratories. Results for the participating laboratories are compared to each other since a "true" value is not known.

Precision samples for both PM_{10} and TSP-sized trace metals are collected at Dearborn (261630033) on a once every 12 day frequency. Additionally, precision samples for TSP-sized trace metals will collected at Port Huron–Rural Street (261470031) starting in 2018.

Plans for the 2019 Trace Metal Network:

During 2019, contingent upon adequate levels of funding, the MDEQ plans to continue collecting trace metal measurements, as described for the above elements at:

- Belding-Merrick St. (260670003) - TSP – lead, manganese, nickel, arsenic and cadmium;
- Grand Rapids-Monroe St. (260810020) - TSP – lead, manganese, nickel, arsenic and cadmium;
- Allen Park (261630001) - TSP – lead, manganese, nickel, arsenic and cadmium;
- Fort St. (SWHS) (261630015) - TSP – lead, manganese, nickel, arsenic and cadmium;
- South Delray (261630027) - TSP – lead, manganese, nickel, arsenic and cadmium;
- River Rouge (261630005) - TSP – lead, manganese, nickel, arsenic and cadmium;
- Dearborn NATTS site (261630033) for both PM_{10} and TSP – metals reported include manganese, nickel, arsenic, cadmium, lead, beryllium, vanadium, chromium, cobalt, copper, zinc, molybdenum, barium and iron;
- Port Huron (261470031) - TSP – lead, manganese, nickel, arsenic and cadmium; and
- New Mount Hermon Church (261630097) - TSP – lead, manganese, nickel, arsenic and cadmium.

The MDEQ is discontinued collecting trace metal measurements in 2018 at:

- Belding-Reed St. (260670002) - TSP – lead, manganese, nickel, arsenic and cadmium.

In July 2018, the MDEQ will add TSP - lead and trace metals to monitoring to the following sites:

- DP4TH (261630099) - TSP – lead, manganese, nickel, arsenic and cadmium;
- Trinity (261630098) - TSP – lead, manganese, nickel, arsenic and cadmium; and
- TBD (261630100) - TSP – lead, manganese, nickel, arsenic, and cadmium.

VOLATILE ORGANIC COMPOUND MONITORING NETWORK

The collection of more than 50 VOCs per sample began at various sites in 1990 as part of the MITAMP air toxics network. Either a once every six day or once every 12 day sampling frequency has been used depending on the site and budget status. The VOC network follows the sampling calendar published by the USEPA. The Detroit-SWHS (261630005) site has been the trend site and has collected VOC samples every year since 1993. The determination of VOC samples on a one every six day sampling frequency using Method TO-15 is required for the NATTS site at Dearborn (261630033). A minimum of six precision (duplicate) samples per year are also collected at Dearborn (261630033) as part of the NATTS program.

Table 27 summarizes the VOC monitoring site information. **Figure 17** illustrates the geographical distribution of VOC monitors in Michigan.

VOC Quality Assurance

Once a year, the QA Team conducts a thru-the-probe audit using a known concentration of specialized calibration gas. The gas is sent through the station sample probe and collected into a clean, evacuated 6-liter Summa canister over a 24-hour period, and analyzed using USEPA Method TO-15. The results are compared to the auditor's target concentration. Once a year, the QA Team also conducts a zero air check on the sampler by running VOC-free air through the probe and into an air canister for 24 hours. The auditor assesses the sampling configuration, including the condition and height of probe and siting criteria.

The MDEQ Laboratory also participates in regional performance test programs. The regional performance test audit is produced by a multi-sampling unit that collects actual ambient air. The results from the participating laboratories are compared to each other since a "true" value is not known. The QA Coordinator receives, reviews, and retains copies of all performance test audit samples. The MDEQ Laboratory also participates in regional round robin samples.

Plans for the 2019 VOC Monitoring Network

During 2019, contingent upon adequate levels of funding, the MDEQ plans to continue collecting VOCs at:

- Detroit-SWHS (261630015) once every 12 days; and
- Dearborn NATTS site (261630033) once every six days and precision samples once every two months

Table 27: Michigan's VOC Monitoring Network

Operating Schedule: 1:6 and 1:12, Follows EPA Published Schedule
Method: Stainless Steel Pressurized Canister Sampler; Gas Chromatograph/ Mass Spectrometer (24-hr samples); Method Code 110

Monitoring Sites												
Site Name	AQS Site ID	Address	Latitude	Longitude	Sampling Frequency	Purpose/ Type	POC	Scale	County	Date Estab.	MSA [1]	Pop (2015 Estimated)
Detroit - SWHS	261630015	150 Waterman	42.302778	-83.106667	1:12	pop exp	1	nghbrhd	Wayne	2/26/99	DWL	4,313,002
Dearborn	261630033	2842 Wyoming	42.306666	-83.148889	1:6	max conc	1	nghbrhd	Wayne	6/1/90	DWL	4,313,002

[1] **MSA Key:** DWL= Detroit-Warren-Livonia MSA

Figure 17: Michigan's VOC Monitoring Network

CARBONYL MONITORING NETWORK

The collection of carbonyl compounds, including formaldehyde and acetaldehyde as part of MITAMP, began at various sites in 1995. Either a once every six day or once every 12 day sampling frequency has been used depending on the site and budget status. The carbonyl network follows the sampling calendar published by the USEPA. The Detroit-SWHS (261630015) site has been the trend site and has collected carbonyl samples every year since 1995.

Levels of formaldehyde in southeast Michigan are very heterogeneous, unlike other areas of the United States. Historical concentrations at River Rouge (261630005) are elevated, so the continuation of this monitor is important for the characterization of risk and for the determination of trends, this runs on a once every 12 day schedule. Detroit-SWHS (261630015) is the MDEQ's air toxic trend site, so monitoring has continued on a once every 12 day schedule. Monitoring for carbonyl compounds on a one in six day frequency using Method TO-11A is required at the Dearborn NATTS site (261630033). Also, as a part of NATTS, six precision samples for carbonyls are collected every year.

The MDEQ in 2019, as part of PAMS, will sample carbonyls at Allen Park (261630001), and also Grand Rapids-Monroe St. (260810020). The sampling will run on a once every three day schedule, with three 8-hour samples collected every run day.

Table 28 summarizes the carbonyl monitoring site information for sites that were in existence in 2018 and will be added in 2019. **Figure 18** shows the distribution of carbonyl samplers across Michigan.

Carbonyl Quality Assurance

Once a year, the QA Team conducts a thru-the-probe audit using a known concentration of specialized calibration gas. The gas is sent through the station sample probe and collected on a dinitrophenyl hydrazine (DNPH) cartridge over a 24-hour period and analyzed using USEPA Method TO-11A. The laboratory result is compared to the auditor's target concentration. The QA Team also conducts a zero air check of the sampler once a year by sending carbonyl-free air through the probe and into the sampler for 24 hours. The auditor assesses the sampling configuration, including the condition and height of probe and siting criteria.

The carbonyl samples are sent to two different labs. NATTS samples go to a National Contract Lab. The National Lab participates in a national performance test program. The lab where the Detroit-SWHS and River Rouge samples go is also required to participate in the NATTS performance test program. The national contractor sends a spiked sample of known compounds and concentrations to the laboratory. The results are compared to the "true" value. The regional performance test audit is produced by a multi-sampling unit that collects actual ambient air. The results from the participating laboratories are compared to each other since a "true" value is not known. The QA Coordinator receives, reviews, and retains copies of all performance test audit samples.

Plans for the 2019 Carbonyl Monitoring Network

During 2019, contingent upon adequate levels of funding, Michigan plans to continue collecting carbonyls at:

- Detroit-SWHS (261630015) once every 12 days;
- River Rouge (261630005) once every 12 days; and
- Dearborn NATTS site (261630033) once every six days and precision sample once every two months.

During 2019, contingent upon adequate levels of funding for the PAMS, Michigan plans to begin collecting carbonyls at:

- Allen Park (261630001); and
- Grand Rapids-Monroe St. (260810020).

Table 28: Michigan's Carbonyl Monitoring Network

Operating Schedule: 1:6 and 1:12, Follows EPA published schedule

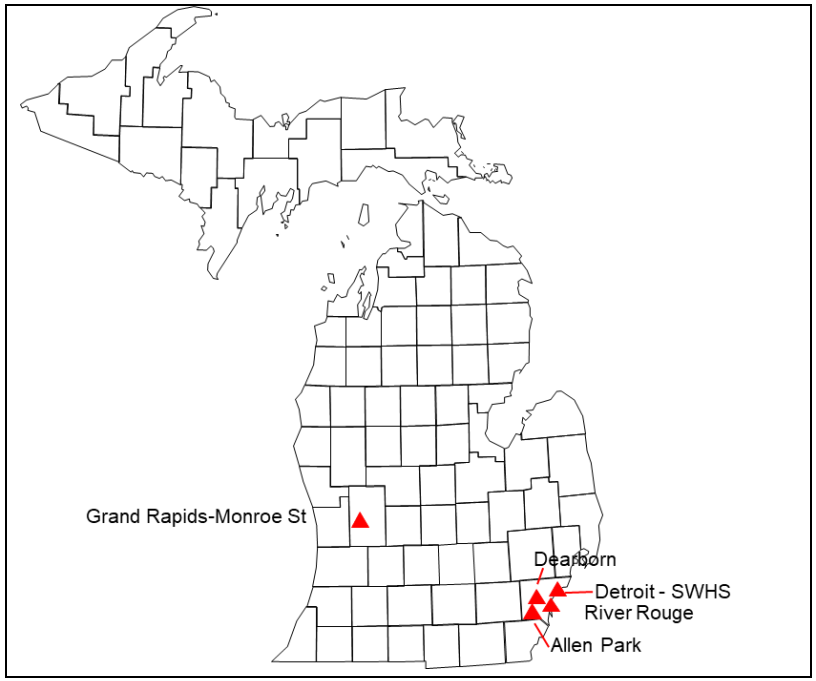
Method: 2,4 dinitrophenyl hydrazine treated silica gel cartridges; HPLC with ultraviolet absorption; Method Code 202

Monitoring Sites													
Site Name	AQS Site ID	Address	Latitude	Longitude	Sampling Frequency	Purpose/ Type	POC	Scale	County	Date Estab.	MSA [1]	Pop (2015 Estimated)
Dearborn	261630033	2842 Wyoming	42.306666	-83.148889	1:6	max conc	1	nghbrhd	Wayne	6/1/90	DWL	4,313,002
River Rouge	261630005	315 Genesee	42.267222	-83.132222	1:12	max conc	1	nghbrhd	Wayne	1/1/94	DWL	4,313,002
Detroit - SWHS	261630015	150 Waterman	42.302778	-83.106667	1:12	pop exp	2	nghbrhd	Wayne	2/26/99	DWL	4,313,002

PAMS Monitoring Sites												
Site Name	AQS Site ID	Address	Latitude	Longitude	Sampling Frequency	Purpose/ Type	POC	Scale	County	Date Estab.	MSA [1]	Pop (2015 Estimated)
Allen Park	261630001	14700 Goddard	42.228611	-83.208333	1:3 (3-8hr samples)	pop exp	1	nghbrhd	Wayne	1/1/19	DWL	4,313,002
Grand Rapids-Monroe St.	260810020	1179 Monroe SE NW	42.956111	-85.679167	1:3 (3-8hr samples)	pop exp	1	nghbrhd	Kent	1/1/19	GW	4,313,002

[1] **MSA Key:** DWL= Detroit-Warren-Livonia MSA
GW = Grand Rapids-Wyoming MSA

Figure 18: Michigan's Carbonyl Monitoring Network



POLYNUCLEAR AROMATIC HYDROCARBONS MONITORING NETWORK

As part of the USEPA's desire to augment the NATTS, PAHs were added to the Dearborn site on April 6, 2008. Samples are collected on a once every six day sampling schedule using an Anderson PS-1 sampler. The PAH network follows the sampling calendar published by the USEPA. The sampler contains a glass thimble filled with prepared polyurethane foam plugs that surround XAD-2 resin. Volatile PAHs are absorbed into the foam and XAD-2 resin. Particle bound PAHs are trapped on a filter that precedes the thimble. A second sampler was deployed to the Dearborn site so six precision samples can be collected each year, conforming to the USEPA's co-location criteria.

The media is sent to the national contract laboratory, Eastern Research Group (ERG), where it is extracted and analyzed according to ASTM test method D 6209, which is equivalent to USEPA method TO-13A.

Table 29 shows the site information for PAH sites that were in operation in 2018. **Figure 19** shows the locations of sites where PAH monitoring occurs.

PAH Quality Assurance

The site operator conducts a precision flow check once a month. The flow check values are sent to the QA Coordinator each quarter. An independent audit is conducted by a member of the AMU's QA Team once a year. The auditor is in a separate line of reporting authority from the site operator and uses independent, dedicated equipment to perform the flow rate audit. The auditor also assesses the condition of the monitor and siting criteria. The QA Coordinator reviews all audit results, and hard copies are retained in the QA files.

Plans for the 2019 PAH Monitoring Network

During 2019, contingent upon adequate levels of funding, Michigan plans to continue collecting PAHs at:

- Dearborn (261630033) – once every six days and precision once every two months.

Table 29: Michigan's PAHs Monitoring Network

Operating Schedule: 1:6 , Follows EPA published schedule

Method: Polyurethane foam plugs and XAD-2 resin with gas chromatography mass spectrometry; Method Code 202

Monitoring Sites														
Site Name	AQS Site ID	Address	Latitude	Longitude	Sampling Frequency	Parameter Code	POC	Purpose/ Type	POC	Scale	County	Date Estab.	MSA [1]	Pop (2015 Estimated)
Dearborn	261630033	2842 Wyoming	42.30667	-83.1489	1:6	various	1	max conc	1	nghbrhd	Wayne	6/1/90	DWL	4,313,002

[1] **MSA Key:** DWL= Detroit-Warren-Livonia MSA

Figure 19: Michigan's PAHs Monitoring Network

PAMS NETWORK

The MDEQ has not operated a Photochemical Assessment Monitoring Station (PAMS) site since before 2001. However, the recently revised monitoring rule (80 FR 65292; October 26, 2015) requires PAMS measurements June 1 through August 31 at NCore sites that are located in Core-based Statistical Areas (CBSAs) with populations of 1,000,000 or more. As long as federal funding is made available for Michigan to fully fund 2 PAMS sites, the MDEQ will implement the following changes to its network starting June 2019.

Network Decision

The NCore sites located at Allen Park (261630001) and Grand Rapids-Monroe St. (260810020) will serve as the locations of the required PAMS sites and will measure the parameters described below. The purchasing process has not yet begun; however, equipment likely to be installed at the sites will be Ceilometers for determining mixing height, Auto-GCs for VOCs, true NO_2 using a direct reading NO_2 analyzer, and carbonyls. National purchasing contract will be used to obtain as much of the instrumentation as possible.

Auto GC Decision

A complete list of the targeted compounds is found in **Table 30.** The MDEQ at this point is planning to measure hourly speciated VOC measurements with an auto-gas chromatograph (GC) using the CAS system.

Meteorology Measurements Decision

The MDEQ will measure wind direction, wind speed, temperature, relative humidity, atmospheric pressure, precipitation, solar radiation, ultraviolet radiation, and mixing height using Ceilometer.

Other Required Measurements

Carbonyl sampling at a frequency of three 8-hour samples on a one-in-three day basis (90 samples per PAMS sampling season) using instrumentation that will be purchased at a later date. A complete list of the target carbonyl compounds may be found in **Table 30**. The TO-11A test method, as used in the National Air Toxics Trends (NATTS) program will be used.

The MDEQ will monitor for NO and NO_Y in addition to true NO_2. The true NO_2 analyzer will be a direct reading NO_2 analyzer, which will be purchased under the National Contract. The NO and NO_Y will be measured using a TECO analyzer.

Table 30: PAMS Target Compound List

Priority Compounds				Optional Compounds			
1	1,2,3-trimethylbenzene [a]	19	n-hexane [b]	1	1,3,5-trimethylbenzene	19	m-diethlybenzene
2	1,2,4-trimethylbenzene [a]	20	n-pentane	2	1-pentene	20	methylcyclohexane
3	1-butene	21	o-ethyltoluene [a]	3	2,2-dimethylbutane	21	methylcyclopentane
4	2,2,4-trimethylpentane [b]	22	o-xylene [a,b]	4	2,3,4-trimethylpentane	22	n-decane
5	acetaldehyde [b,c]	23	p-ethyltoluene [a]	5	2,3-dimethylbutane	23	n-heptane
6	acetone [c,d]	24	Propane	6	2,3-dimethylpentane	24	n-nonane
7	benzene [a,b]	25	propylene	7	2,4-dimethylpentane	25	n-octane
8	c-2-butene	26	styrene [a,b]	8	2-methylheptane	26	n-propylbenzene [a]
9	ethane [d]	27	toluene [a,b]	9	2-methylhexane	27	n-undecane
10	ethylbenzene [a,b]	28	t-2-butene	10	2-methylpentane	28	p-diethylbenzene
11	Ethylene			11	3-methylheptane	29	t-2-pentene
12	formaldehyde [b,c]			12	3-methylhexane	30	α/β-pinene
13	Isobutane			13	3-methylpentane	31	1,3 butadiene [b]
14	Isopentane			14	Acetylene	32	benzaldehyde [c]
15	Isoprene			15	c-2-pentene	33	carbon tetrachloride [b]
16	m&p-xylenes [a,b]			16	cyclohexane	34	Ethanol
17	m-ethyltoluene [a]			17	cyclopentane	35	Tetrachloroethylene [b]
18	n-butane			18	isopropylbenzene [b]		

Source: Revisions to the Photochemical Assessment Monitoring Stations Compound Target List. USEPA, November 20, 2013

[a] Important SOAP (Secondary Organic Aerosols Precursor) compounds
[b] HAP (Hazardous Air Pollutant) compounds
[c] Carbonyl compounds
[d] Non-reactive compounds, not considered to be VOC for regulatory purposes

METEOROLOGICAL MEASUREMENTS

Various meteorological measurements have been added to supplement the ambient monitoring network and enhance data analysis activities. A description of the types of meteorological measurements that are made at each site is provided in **Table 31**. The MDEQ is not planning any changes to the meteorological measurements.

Meteorological Equipment Quality Assurance

On an annual basis, an Equipment Technician conducts a multi-speed and directional certification of the propeller anemometer and vane systems. The QA Team staff or Senior Environmental Technician performs a "sun shot" to check the true north orientation of the anemometer and vane system at the station.

An independent audit is conducted by the QA Team to assess the accuracy of the indoor and outdoor temperature, barometric pressure, and relative humidity measurements at the site. The comparison is done between the station's measurements and the auditor's certified thermometer, barometer, and hygrometer to ensure quality objectives are being met. The QA Coordinator reviews the results of both the wind speed and wind direction certifications as well as the independent audits. Hard copies of all assessments are retained in the QA file system.

Plans for the 2018 Meteorological Monitoring Network

During 2019, contingent upon adequate levels of funding, Michigan plans to continue collecting hourly meteorological measurements at:

- Holland (26005003)
- Bay City (260170014)
- Coloma (260210014)
- Cassopolis (260270003)
- Flint (260490021)
- Otisville (260492001)
- Harbor Beach (260630007)
- Lansing Filley (260650018)
- Kalamazoo (260770008)
- Grand Rapids–Monroe St. (260810020)
- Evans (280810022)
- Tecumseh (260910007)
- New Haven (260990009)
- Sterling Heights/Freedom Hill (260990021)
- Scottville (261050007)
- Houghton Lake (261130001)
- Sterling State Park–Monroe (261150006)
- Muskegon–Green Creek Rd. (261210039)
- Oak Park (261250001)
- Pontiac (261250011)
- Rochester (261250012)
- Jenison (261390005)
- West Olive (261390011)
- Port Huron (261470005)
- Seney (261530001)

- Ypsilanti (261610008)
- Allen Park (261630001)
- River Rouge (261630005)
- Detroit–SWHS (261630015)
- Detroit–E 7 Mile (261630019)
- Livonia Near-road (261630095)
- Detroit-Joy Rd. (261630026)
- Dearborn (261630033)
- Eliza Howell (261630093)
- Trinity (261630099)

To the best of our knowledge, the following tribal meteorological equipment monitor will continue operation:

- Manistee (261010922)
- Sault Ste. Marie (260330901)

Table 31: Meteorological Measurements in Michigan

Site Name	AQS ID	WS 61103	WD 61104	Outside Temperature 62101	Relative Humidity 62201	Barometric Pressure 64101	Solar Radiation 63301	Sigma Theta 61106
Holland	260050003	X	X	X	X	X	X	X
Bay City	260170014	X	X	X				X
Coloma	260210014	X	X	X				X
Cassopolis	260270003	X	X	X				X
Sault Ste Marie *	260330901	X	X	X		X		X
Flint	260490021	X	X	X	X	X		X
Otisville	260492001	X	X	X	X	X		X
Harbor Bach	260630007	X	X	X	X			X
Lansing	260650018	X	X	X	X	X		X
Kalamazoo	260770008	X	X	X	X			X
Grand Rapids-Monroe St.	260810020	X	X	X	X	X		X
Evans	260810022	X	X	X	X			X
Tecumseh	260910007	X	X	X	X	X		X
New Haven	260990009	X	X	X	X		X	X
Sterling Heights. /Freedom Hill	260990021	X	X	X	X			X
Manistee *	261010922	X	X	X	X	X	X	X
Scottville	261050007	X	X	X	X			X
Houghton Lake	261130001	X	X	X	X	X		X
Sterling State Park-Monroe	2611500006	X	X	X	X			X
Muskegon, Green Creek Rd.	261210039	X	X	X	X			X
Oak Park	261250001	X	X	X	X	X		X
Pontiac	261250011	X	X	X	X			X
Rochester	261250012	X	X	X	X			X
Jenison	261390005	X	X	X	X			X
West Olive	261390011	X	X	X	X			X
Port Huron	261470005	X	X	X	X	X		X
Seney	261530001	X	X	X	X	X	X	X
Ypsilanti	261610008	X	X	X	X	X		X
Allen Park	261630001	X	X	X	X	X		X
River Rouge	261630005	X	X	X	X			X
Detroit-SWHS	261630015	X	X	X	X	X		X
Detroit-E7 Mile	261630019	X	X	X	X	X		X
Livonia Near Rd.	261630095	X	X	X	X	X		X
Detroit-Joy Rd.	261630026	X	X	X				X
Dearborn	261630033	X	X	X	X	X		X
Eliza Howell-Roadside	261630093	X	X	X				X
Trinity	261630099	X	X	X		X		X

SPECIAL PURPOSE MONITORS

The MDEQ is currently working on three special projects. The first project is a Community Scale Air Toxics Ambient Monitoring (CSATAM) grant. In 2015, the MDEQ applied for the grant to study near roadway emissions at three sites in Detroit: Eliza Howell Near-road (261630093), Eliza Howell Downwind (261630094), and Livonia Near-road (261630095). The grant involves a minimum of two years of monitoring at these sites, with a three-month intensive where additional samples and increased sampling frequency will be employed. The monitoring portion of this study has concluded, and the final data analysis is currently underway. The monitoring for CO, NO_2 and $PM_{2.5}$ at these sites are classified as SLAMS .

The second special purpose monitoring project (which comes under SLAMS) resulted from a request from community members in the Detroit 48217 ZIP code for an air monitoring station in their neighborhood. The 48217 community has many industrial sources located in and around it. As such, the MDEQ has agreed to continue monitoring past the approved one-year study. The NMH 48217 (261630097) site is located at New Mount Hermon Church at 3225 S. Deacon Street in Detroit. Data was analyzed at the end of the one-year study (September 2017), and a determination was made to shut down some of the parameters that were being collected. The site now monitors only for SO_2, $PM_{2.5,}$ TEOM, and TSP metals.

The third special purpose monitoring project has resulted due to the proposed Gordie Howe International Bridge project. It will involve additional monitoring at three new sites and the existing Detroit–SWHS site beginning July 2018. This monitoring project was made possible by a grant from the Michigan State Housing Development Authority. The MDEQ will conduct ambient air quality monitoring in the Delray area of Detroit to ascertain air pollution levels. This area is being impacted by the construction of a new International Bridge Crossing. The monitoring will start before bridge construction occurs to determine the effect of earth moving and house demolition equipment. The monitoring project will continue the first few years of bridge operation to understand the role that traffic plays in the air quality of the Delray area. **Table 32** shows the instruments that are planned for deployment. The length of this study is not known, however under an agreement with the City of Detroit and the Governor's Office, the MDEQ has agreed to keep SWHS and one other site running for 10 years. The duration of the other sites will depend on an annual review of the data.

Table 32: Instruments to be added at Gordie Howe International Bridge Project Study

Site	Address	Instrument	Sampling Frequency
SWHS (261630015)	150 Waterman	$PM_{2.5}$-BAM	Hourly
		Black Carbon-Aethalometer	Hourly
		SO_2	Hourly
		NOx	Hourly
		TSP-Pb	24-hr every 6 day
DP4TH (261630098)	4700 W. Fort St.	SO_2	Hourly
		CO	Hourly
		NOx	Hourly
		$PM_{2.5}$-BAM	Hourly
		Black Carbon-Aethalometer	Hourly
		TSP-Pb	24-hr every 6 day
Trinity (261630099)	9191 W. Fort St.	MET	Hourly
		SO_2	Hourly
		CO	Hourly
		NOx	Hourly
		$PM_{2.5}$-BAM	Hourly
		Black Carbon-Aethalometer	Hourly
		TSP-Pb	24-hr every 6 day
TBD (261630100)	.	SO_2	Hourly
		NOx	Hourly
		$PM_{2.5}$-BAM	Hourly
		Black Carbon-Aethalometer	Hourly
		TSP-Pb	24-hr every 6 day

ADEQUACY OF MICHIGAN'S MONITORING SITES

The suitability of monitoring site locations is frequently assessed by the AMU's QA Team and the USEPA. The USEPA assesses the adequacy of the stations during $PM_{2.5}$ PEP audits, gaseous NPAP audits, and systems audits. The results indicate that the stations are properly sited, which includes distances away from obstructions, large trees, and set-backs from roadways. Suitability of probe heights and separation distances are assessed both by MDEQ and USEPA auditors. If any issues are found during the audits, the MDEQ works with USEPA Region 5 to correct them during the audit follow-up process.

The Dearborn NATTS Site (261630033) has an issue with a tree dripline being too close to some of the monitors located on the sampler deck. The tree is located on private property, and therefore the MDEQ has no authority to remove the tree. The MDEQ was able to move the deck to the west side of the bunker, so that the tree drip line will no longer be an issue.

Table 33 summarizes the various monitoring waivers the MDEQ has requested.

Table 33: Summary of Waivers for Michigan's Monitoring Network

Type of Wavier	Explanation
Ozone Monitor	The Ann Arbor MSA does not have enough space for the downwind monitor in Washtenaw County, therefore the MDEQ requests to place it in Oakland County
Lead Co-location	There is not a large enough foot print at the Belding monitoring sites to co-locate a lead monitor. Therefore, the MDEQ requests to leave the lead co-location at Dearborn. Originally requested in 2010.
Lead Monitoring	Request to waive lead monitoring at Consumer's JH Campbell plant. Modeling shows low impact. Originally requested in 2009 and re-submitted in 2014. Needs to be renewed every 5 years.
Lead Monitoring	Request to waive lead monitoring at St. Mary's Cement plant. Modeling shows low impact. Originally requested in 2009 and resubmitted in 2014. Needs to be renewed every 5 years.
Lead Monitoring	Request to waive lead monitoring at Consumer's Karn-Weadock plant. Modeling shows low impact. Originally requested in 2011 and resubmitted in 2016. Needs to be renewed every 5 years.

APPENDIX A: ACRONYMS AND THEIR DEFINITIONS:

Acronym	Definition
>	Greater than
<	Less than
≥	Greater than or equal to
≤	Less than or equal to
%	Percent
µg/m^3	Micrograms per cubic meter
AERMOD	AMS/USEPA Regulatory Model
AMU	Air Monitoring Unit
AQD	Air Quality Division
AQS	Air Quality System (USEPA air monitoring data archive)
ARM	Approved regional method
BAM	Beta Attenuation Monitor (hourly $PM_{2.5}$ measurement monitor)
CAA	Clean Air Act
CASTNET	Clean Air Status and Trends Network
CBSA	Core-Based Statistical Area
CFR	Code of Federal Regulations
CO	Carbon monoxide
CSA	Consolidated Statistical Area
DNPH	2,4 -di nitrophenyl hydrazine – this is the derivatizing agent on the cartridges used to collect carbonyl samples
DPW	Department of Public Works
EC	Elemental carbon
USEPA	U.S. Environmental Protection Agency
FDMS	Filter Dynamic Measurement System
FEM	Federal Equivalent Method
FIA	Family Independence Agency
FRM	Federal Reference Method
GC	Gas chromatograph (instrument providing VOC measurements)
GFIs	Ground fault circuit interrupters
hr	Hour
IN-MI	Indiana-Michigan
LADCO	Lake Michigan Air Directors Consortium
DEQ	Michigan Department of Environmental Quality
MITAMP	Michigan Toxics Air Monitoring Program
MSA	Metropolitan Statistical Area
NAAQS	National Ambient Air Quality Standard
NAMS	National Air Monitoring Station
NATTS	National Air Toxics Trend Sites
NCore	National Core Monitoring Sites
NEI	National Emission Inventory
NO_2	Nitrogen dioxide
NO_X	Oxides of Nitrogen
NO_Y	Oxides of nitrogen + nitric acid + organic and inorganic nitrates
NPAP	National Performance Audit Program
OAQPS	Office of Air Quality and Planning and Standards (USEPA)
OC	Organic carbon
OTAQ	Office of Transportation and Air Quality (USEPA)

Acronym	Definition
PAH	Polynuclear Aromatic Hydrocarbon
PAMS	Photochemical Assessment Monitoring Station
PEP	Performance Evaluation Program
PM	Particulate matter
PM2.5	Particulate matter with an aerodynamic diameter less than or equal to 2.5 microns
PM10	Particulate matter with a diameter of 10 microns or less
PM10-2.5	Coarse PM equal to the concentration difference between PM10 and PM2.5
ppb	parts per billion
ppm	parts per million = mg/kg, mg/L, µg/g (1 ppm = 1,000 ppb)
QA	Quality assurance
QAPP	Quality Assurance Project Plan
RTI	Research Triangle Institute (national contract laboratory for speciated PM2.5)
SLAMS	State and Local Air Monitoring Station
SO2	Sulfur dioxide
STAG	State Air Grant (federal)
STN	Speciation Trend Network (PM2.5)
TEOM	Tapered element oscillating microbalance (hourly PM2.5 measurement monitor)
tpy	ton per year
TRI	Toxic Release Inventory
TSP	Total Suspended Particulate
U of M	University of Michigan
U.S.	United States
VOC	Volatile organic compounds

Appendix B: Summary of Comments Received and Replies

As part of the network review process, the EPA requires that the MDEQ solicit public comments. The MDEQ made the draft 2019 Network Review available for public comment by posting the document on its air quality homepage. To ensure that the public was aware that the document was open for comment, the 30-day public comment period was announced through the Air Quality Listserv and via a press release on May 31, 2018.

The MDEQ received one comment to the network review.

Comment:

It was recommended that the PAMS site in SE Michigan be relocated from Allen Park (an NCORE site) to E 7 Mile. E 7 Mile site represents the ozone design value for SE Michigan. The commenter believes that NO_x and VOC measurements at E 7 Mile will provide data that will be useful in determining the relative benefits of VOC and NO_x emission reductions and assist in developing an optimum cost-effective control strategy for SE Michigan.

Response:

The MDEQ has a requirement to operate a photochemical air monitoring station (PAMS) at both NCore sites, located in Grand Rapids and Allen Park. To relocate the PAMS station from Allen Park to the Detroit E 7 Mile site would require a waiver from the USEPA. PAMS stations are required to be operated at the NCore sites where reactive oxides of nitrogen, NOy are also measured. To obtain a waiver from the USEPA to locate the PAMS station at a non-NCore site would require the MDEQ to install a NOy monitor at the E 7 Mile site. Adding an additional NOy instrument to the E 7 Mile site would be a significant expense for equipment and labor. The MDEQ would only be able to shut down the NOy instrument at the existing NCore site at Allen Park if a side-by-side demonstration of NOy and NOx at the site could demonstrate a 'negligible' difference in the measured values. It is unknown to the MDEQ how long this demonstration would need to be conducted nor what constitutes a negligible difference in values. If MDEQ is able to obtain a waiver from the USEPA to operate the PAMS station at the E 7 Mile site and if a waiver is granted to move the NOy instrument from Allen Park to the E 7 Mile site, the MDEQ will grant this request.

Appendix C: Written Comments Received

NAVNIT K. GHUMAN
MDEQ AIR QUALITY DIVISION
3058 W GRAND BLVD, SUITE 2-300
DETROIT MI 48202

June 20, 2018

Comments on "Michigan's 2019 Ambient Air Monitoring Network Review"

As consulting scientists to the Southeast Michigan Air Quality Study (SEMAQS) on ozone, Dr. Jay Turner of Washington University in St. Louis, and I strongly recommend that the PAMS site in SE Michigan be relocated from Allen Park to E 7 Mile.

US EPA has declared SE Michigan a marginal ozone nonattainment area which requires the development of a State Implementation Plan and attainment in 3 years. Ozone formation depends not only on the ambient concentrations of NO_x and VOC, but also critically on the VOC/NO_x ratio. From our analyses in SE Michigan, the maximum 8-hr on a given day appears to be sensitive to ratio near the present Design Value site at East 7 Mile. On the other hand, the ratio at the Allen Park site appears to be more invariant as it is dominated by local highway emissions and provides no information about the downwind O_3 maxima.

Thus, we believe NO_x and VOC measurements at E7 Mile will provide data that will be useful in determining the relative benefits of VOC and NO_x emission reductions and assist in developing an optimum cost-effective control strategy for SE Michigan.

Please contact me if you need additional information.

Sincerely,

George T. Wolff, Ph.D.
Atmospheric Scientist
Air Improvement Resource, Inc.
Farmington Hills, MI

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SEMCOG is in agreement with this recommendation based on the overall ozone analyses and review recently completed by Dr. Turner and Dr. Wolff on behalf of the Southeast Michigan Air Quality Study workgroup.

Thanks!

Kelly Karll, PE
Plan Implementation
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